Public Health Assessment

EASTERN MICHAUD FLATS CONTAMINATION
Bannock County, Idaho; Power County, Idaho; Fort Hall Indian Reservation

EPA FACILITY ID: IDD984666610

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ACRONYMS

AOC	Administrative Order on Consent
ATSDR	Agency of Toxic Substances and Disease Registry
BAPCO	Bannock Paving Company
BCEH	Bureau of Community and Environmental Health
BLM	Bureau of Land Management
CBG	Census Block Group
CDRI	Cancer Data Registry of Idaho
COC	Contaminants of Concern
CV	Comparison Value
EMF	Eastern Michaud Flats
EPA	United States Environmental Protection Agency
FMC	FMC Corporation
HOD	Health Outcome Data
IDEQ	Idaho Department of Environmental Quality
MCL	maximum contaminant level
MRL	minimal risk level
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OU	operable unit
PM	particulate matter
PM10	particulate matter smaller than 10 microns
PM2.5	particulate matter smaller than 2.5 microns
RI/FS	Remedial Investigation/Feasibility Study
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
Simplot	J.R. Simplot Company
$\mu g/m^3$	micrograms per cubic meter

SUMMARY

The Eastern Michaud Flats (EMF) Contamination site covers 2,530 acres near Pocatello, Idaho. Within the site boundaries are two adjacent phosphate ore processing facilities, the FMC Corporation (FMC) and the J.R. Simplot Company (Simplot). The disposal of by-product waste material at and around the facilities and air emissions (fugitive and direct discharges) from the facilities have contributed to environmental contamination associated with the EMF site, which was listed on the U.S. Environmental Protection Agency's (EPA) National Priority List (NPL) on August 30, 1990. Since 1990, the Agency for Toxic Substances and Disease Registry (ATSDR) has evaluated potential exposure to site-related contaminants and released a preliminary public health assessment and several health consultations for the site. The Bureau of Community and Environmental Health (BCEH), Division of Health, Idaho Department of Health and Welfare (IDHW) has a cooperative agreement with ATSDR to conduct public health assessments and consultations for hazardous waste sites in Idaho.

As part of this cooperative agreement, BCEH conducted this comprehensive public health assessment. In this public health assessment, BCEH revisited the conclusions and recommendations made in past health consultations for groundwater, surface soil, surface water/sediment and air contamination (ATSDR 1998a, 1998b, 1998c, 2001a), and reviewed new environmental data, information regarding site operations (i.e. closure of the FMC facility), health data, and community health concerns. In addition, BCEH conducted a cancer incidence analysis for the Pocatello and Fort Hall area in conjunction with the Cancer Data Registry of Idaho (CDRI). This public health assessment recommends actions to prevent, reduce, or further identify the possibility for site-related adverse health effects, as appropriate.

Based upon the data and information reviewed, BCEH has drawn the following conclusions and recommendations:

Conclusions

1. **The current** completed exposure pathways include surface soil, surface water/sediment, air, and residential exposure to radiation from slag. A potential exposure pathway exists for site-related contaminants for individuals who consume fish from the Portneuf River. The groundwater exposure pathway is currently an eliminated exposure pathway and has been since the early 1990's.

2. **In the past**, the EMF site was classified as a *Public Health Hazard* according to ATSDR's Interim Public Health Hazard Categories (Appendix C), based on past exposure: 1) to groundwater from the Old Pilot Café well, the Frontier well, and Batiste Spring; 2) of FMC workers to cadmium in surface soils; 3) of slag and gypsum workers at both facilities to alpha, beta, and gamma radiation; and 4) of the general public to air contamination. It was determined that:

    - Long term (greater than a year) employees at the Old Pilot Café (from the early 1950's through 1976) and the Frontier Building (from 1943 to the late 1980's) may be at higher

risk of developing skin, liver, bladder, and kidney cancers if they drank a significant amount of water at work due to elevated arsenic concentrations in the drinking water. These same people may also have lower production of red and white blood cells, abnormal heart rhythm, and blood-vessel damage (e.g., Raynaud's disease and cyanosis of fingers and toes).

- If an infant (less than four months of age) was fed formula made with water from the Old Pilot Café well (prior to 1976) or the Batiste Spring (before early 1990's) for several days, the infant would have had an increased risk of developing acute acquired methemoglobinemia ("blue baby syndrome") due to elevated nitrate/nitrite concentrations in the drinking water. Symptoms of methemoglobinemia would be apparent within a few days of exposure.

- Workers at the FMC facility (before FMC ceased production of elemental phosphorous in December 2001) may have been exposed to cadmium contaminated surface soil. These exposures may have increased the potential for the workers who smoke to develop proteinuria (excess proteins found in the urine because of damage to the kidneys).

- Depending upon work practices (e.g., amount of dust generated and personal protective devices used) and personal hygiene habits (e.g., how often hands are washed), slag or gypsum pile workers at both facilities may have been exposed to gross alpha, beta, and gamma radiation. These exposures may have increased the cancer risk for slag or gypsum pile workers. However, these past exposures could have been significantly reduced by good occupational practices (e.g., shielding provided by vehicles and dust control), thereby significantly reducing the workers' risk of developing cancer.

- Before 2000, levels of particulate matter in air throughout Chubbuck and Pocatello, as well as part of the Fort Hall Indian Reservation between FMC and Interstate 86, periodically exceeded EPA's health-based comparison values for PM10 and PM2.5 reaching unhealthy air pollution levels as a result of emissions from FMC, Simplot, and other sources.

3. **At present**, BCEH classifies the EMF site as a *No Apparent Public Health Hazard* because 1) no one is drinking site-contaminated groundwater; 2) the FMC facility no longer employs production workers at the site; 3) the annual average concentrations of PM10 and PM2.5 steadily decreased between 2000 and 2003, and PM10 levels exceeded EPA's health-based comparison value only once (April 23, 2002) since 2001.

4. **In the future**, there are some uncertainties about the public health hazard associated with air contamination. Although PM10 and PM2.5 in the EMF area have seldom exceeded EPA's health-based comparison values since 2001, BCEH is not certain that unhealthy PM levels (such as those that occurred during a severe winter inversion in December 1999) will not happen again in severe inversion-producing conditions. Therefore, BCEH recommends that measures to control air pollution remain in place and classifies the EMF site as an *Indeterminate Public Health Hazard* in the future.

5. Gypsum pile workers at the Simplot facility may presently be exposed to elevated levels of alpha, beta, and gamma radiation. These exposures may increase the risk of a worker developing cancer. However these exposures could be significantly reduced by following good occupational practices (e.g., shielding provided by vehicles and dust control), thereby significantly reducing the workers' risk of developing cancer.

6. Due to the limited available data, BCEH can not accurately evaluate the health effects of exposure to the radiation from slag used in the communities at this time.

7. Due to lack of site-related contaminants data in the fish tissue, BCEH can not evaluate the possible health effects of consumption of fish from the Portneuf River at this time.

8. The health outcome data analysis for the cities of Pocatello and Chubbuck and for the Fort Hall Reservation does not indicate any increased cancer incidence for cancers known to be associated with site-related contaminants except for female bladder cancer. However, this association may be due to a potential underestimation of state-wide cancer rates for cancer cases geocoded at fine levels of geographic detail.

9. The health concerns expressed by community members in the EMF area (i.e. health effects of air pollution, fugitive emissions from the gypsum stack, odor complaints, etc.) were reviewed and are reasonably consistent with the contamination on the EMF site. ATSDR, Simplot, and IDEQ are addressing these health concerns (i.e. ATSDR's health study, Simplot's fugitive emission control from permanent roads on the gypsum stack, and odor reduction and odor management plans).

10. The conclusions in this report only apply to the current site conditions. If land uses change, these conclusions may no longer be applicable.

Recommendations

1. Appropriate remedial actions, worker protection activities, and worker safety procedures should be instituted or continued to prevent workers from exposures to site-related contaminants in surface soil, surface water and sediment, such as a worker protection plan to protect gypsum workers of Simplot from radiation exposures.

2. Appropriate remedial actions and monitoring should be instituted or continued to prevent surface soil contaminants from migrating into the local groundwater and surface water, as well as to prevent future migration of site-related groundwater contaminants into any drinking water sources.

3. The land deed restrictions instituted and planned for the property presently owned by FMC and Simplot should remain in effect so that the land will not be developed into residential or agricultural areas, and the shallow groundwater will not be used for drinking water.

4. FMC and Simplot should continue to monitor the groundwater to assure that site-related contaminants do not impact drinking water sources.

5. Idaho Department of Environmental Quality (IDEQ) and the Shoshone-Bannock Tribes should continue to monitor air contamination to further characterize air quality trends (including PM10 and PM 2.5). Analysis of PM10 filters for metals and inorganics (Chemical Mass Balance) should be done on a regular basis to address chronic exposure to metals.

6. IDEQ should continue to issue warnings on days when levels of air pollution are expected to reach potentially unhealthy levels and to communicate these warnings to the local public and media.

7. EPA, IDEQ, the Shoshone-Bannock Tribes, and the cities of Chubbuck and Pocatello should continue to develop, implement, and enforce air pollution control initiatives to minimize the amount of particulate matter released to the air in the EMF area.

8. Concerned homeowners and other building owners in the Pocatello area and on the Fort Hall Reservation area should contact the Southeast Idaho District Health Department to participate in the voluntary Slag Exposure Study, which is still ongoing.

9. The suspension on the sale of slag for all construction uses should remain in place.

10. BCEH should coordinate with Idaho Department of Fish and Game (IDFG) to test fish from the Portneuf River for PCBs and heavy metals and then evaluate possible health effects associated with eating fish from the Portneuf River.

11. IDEQ should continue to work with Simplot to address site odor issues. IDEQ should also continue to track odor complaints (in particular, residential or industrial areas where complaints originate) and health effects associated with these odors and follow up with exposure point monitoring as appropriate.

12. In response to community health concerns, cancer surveillance in the EMF area should continue including an analysis of cancer incidence for Shoshone-Bannock Tribal members.

Public Health Action Plan

1. BCEH has assembled the Eastern Michaud Flats Work Group, which consists of state, federal, and tribal environmental and health agency staff and community members, to assist and advise in the implementation of community health education activities. BCEH will continue to conduct health education/outreach activities as needed.

2. FMC and EPA are working on a Supplemental Remedial Investigation and Feasibility Study for the FMC operable unit based on potential future industrial or commercial redevelopment of the FMC facility.

3. IDEQ has completed the *Portneuf Valley PM_{10} Nonattainment Area (PVNAA) State Implementation Plan (SIP), Maintenance Plan, and Redesignation Request*. This plan outlines that Pocatello, Chubbuck, Inkom and a portion of the Fort Hall Reservation will

ensure continued attainment of the Clean Air Act National Ambient Air Quality Standards (NAAQS) for annual and 24-hour PM_{10}.

4. EPA, Southeastern District Health Department, and FMC are conducting the ongoing Idaho Slag Exposure study, which is a voluntary program to help residents find out if phosphorus slag in their homes and business properties is causing unacceptably high exposure to radiation.

5. BCEH will further evaluate slag exposure data generated by the Slag Exposure Study when and if it becomes available.

6. BCEH will work with Idaho Department of Fish and Game (IDFG) and the IDHW Bureau of Laboratories to analyze edible fish harvested from the Portneuf River for site-related contaminants. BCEH will evaluate possible health effects associated with fish consumed from the Portneuf River.

7. BCEH and CDRI will periodically monitor cancer incidence.

8. ATSDR is conducting a health study to determine if an association exists between past particulate matter air pollution exposures and hospital admissions and other visits (including emergency room, urgent care, and family practice) for heart and lung conditions. Because of the availability of quality exposure data, this study is limited to the residents of Chubbuck and Pocatello.

9. The Shoshone-Bannock Tribes, FMC, and independent experts will conduct a Tribal Health Study for the Shoshone-Bannock Tribes using existing data provided by the Fort Hall Clinic and the Cancer Data Registry of Idaho. This study is funded by FMC under the Resource Conservation and Recovery Act (RCRA) Consent Decree as part of a Special Environmental Project (SEP #14).

10. Simplot is in the process of enacting cleanup and monitoring requirements of its Consent Decree that addresses identified sources of threats to public health.

11. BCEH will review new environmental sampling data and studies relevant to the public health of communities near the EMF site as they become available.

1. PURPOSE AND HEALTH ISSUES

The Bureau of Community and Environmental Health (BCEH), Division of Health, Idaho Department of Health and Welfare has a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR) to conduct public health assessments and consultations for hazardous waste sites in Idaho. BCEH completed this public health assessment of the Eastern Michaud Flats (EMF) Contamination National Priorities List (NPL) site under this cooperative agreement.

A public health assessment is a tool used to determine if contamination at a hazardous waste site poses a public health risk and if actions are needed to protect the health of community members residing or working at or near a hazardous waste site. For this public health assessment, BCEH revisited the conclusions and recommendations made in past health consultations for groundwater, surface soil, surface water/sediment and air contamination (ATSDR 1998a, 1998b, 1998c, 2001), and reviewed new environmental data, information regarding site operations (i.e. closure of the FMC facility), health data, and community health concerns. In addition, BCEH conducted a cancer incidence analysis for the Pocatello and Fort Hall area in conjunction with the Cancer Data Registry of Idaho (CDRI). This public health assessment recommends actions to prevent, reduce, or further identify the possibility for site-related adverse health effects, as appropriate.

2. BACKGROUND

2.1 Site Description

The EMF site covers 2,530 acres near Pocatello, Idaho. Within the site boundaries are two adjacent phosphate ore processing facilities, the FMC Corporation (FMC) and the J.R. Simplot Company (Simplot) (see Appendix A, Figure A-1).

The FMC facility, FMC Elemental Phosphorus Plant, covers an estimated 1,189 acres, almost all of which lie within the Fort Hall Indian Reservation (see Appendix A, Figure A-2). The FMC facility adjoins the western boundary of the Simplot facility. Approximately 560 people were employed at the FMC Elemental Phosphorus Plant before FMC ceased production of elemental phosphorous from phosphate ore at the facility in December 2001. The FMC facility began producing phosphorous in 1949. Some of the facility's processes changed little during the time FMC was in operation. Phosphate-bearing shale was shipped to FMC via the Union Pacific Railroad during the summer months and stored on site in large stockpiles. Ore could not be shipped during the winter months because the ore tended to freeze in the rail cars. After passing through several mechanical processes (e.g., crushing), the phosphate rock was fed to calciners, which removed moisture from the feed. A mixture of this intermediate product, coke, and silica were then further processed in one of the facility's four electric arc furnaces. Outputs from the furnaces included gaseous elemental phosphorus, various gaseous by-products (some of which contain radiological components), and solid wastes called "slag" and "ferrophos" (Bechtel 1996). The elemental phosphorus was subsequently condensed to a liquid state and eventually shipped off-site, and the solid wastes were disposed of at various on-site and off-site locations (IDEQ 2004a). FMC's elemental phosphorus production process included calcining, electric arc furnaces and product handling and shipment. Primary waste products associated with the process were slurried (water conveyed) solids, formerly deposited in numerous unlined and lined ponds, and furnace slag. Approximately 1.5 million tons of ore were processed at the plant annually. The historic disposal of by-product waste material at and around the facility resulted in slag piles covering large areas of land. In addition, former air emissions (fugitive and direct discharges) from the facility contributed to the environmental contamination associated with the EMF site.

The Simplot facility is an active phosphate processing plant. It covers about 745 acres, none of which are on Fort Hall Indian Reservation property, and adjoins the eastern property boundary of

the FMC facility. Around 460 people work at the Simplot facility. The plant began production of single superphosphate fertilizer in 1944. In 1954, the facility began producing phosphoric acid. The Simplot facility uses sulfuric acid to produce phosphoric acid. Phosphoric acid is presently produced by using a wet (aqueous) process. Formerly, phosphate ore was transported from the mines to the facility via rail. As of September 1991, the Simplot facility began receiving phosphate ore through a slurry pipeline direct from mines. The phosphate ore slurry is processed at the Simplot facility in phosphoric acid reactors and then further processed into a variety of solid and liquid fertilizers. The facility produces 12 principal products, including phosphoric acid, five grades of solid fertilizers, and four grades of liquid fertilizers (Bechtel 1996). Simplot primarily produces phosphogypsum as waste product, initially placed as a slurry in ponds and then redeposited in extensive "stacks". Phosphogypsum is primarily gypsum but includes numerous impurities resulting from the ore processing. Other contaminants associated with sources include arsenic, selenium, zinc, cadmium, vanadium, fluoride, sodium, potassium, chloride, nitrates, ammonia, and sulfate (IDEQ 2004a). The disposal of by-product waste material (e.g., gypsum) at and around the facility and air emissions (fugitive and direct discharges) from the facility have contributed to the environmental contamination associated with the EMF site.

The Eastern Michaud Flats are on the Snake River Plain and are bordered by the American Falls Reservoir, the Portneuf River, Rock Creek, and on the south by the foothills of the Deep Creek Mountains and Bannock Range. The Portneuf River, which is adjacent to the Northeast corner of the Simplot facility, is used for fishing, recreation, and irrigation downstream from the site. According to the Idaho Department of Environmental Quality (IDEQ), groundwater from beneath the site discharges into the river at Batiste and Swanson Road Springs (Wicherski 2004).

2.2 Regulatory and Non-regulatory History

Since 1972, the State of Idaho, the U.S. Geological Survey (USGS), the U.S. Environmental Protection Agency (EPA), and the owners of the two facilities have conducted various investigations at and around the two facilities that make up the EMF site (Bechtel 1996). The results of these investigations indicated that the activities at the two facilities have resulted in the contamination of the surrounding environment. Because of the environmental contamination and the potential for human exposure to the contaminants, the EPA placed the site on the NPL on August 30, 1990.

In accordance with ATSDR's Congressional Mandate to conduct a public health assessment at all newly proposed NPL sites, ATSDR completed a Preliminary Public Health Assessment in August 1990, which evaluated potential exposure to site-related contaminants. At the time of the Preliminary Public Health Assessment, ATSDR determined the EMF site to be a potential public health concern due to potential past, present and future human exposures to site-related contaminants.

Since 1990, ATSDR has performed several public health evaluations of exposures to contaminants associated with the EMF site. In response to a request from the Shoshone-Bannock Tribes in 1992, ATSDR conducted a study of Fort Hall reservation residents to determine if site emissions were impacting their health. The resulting 1995 Fort Hall Air Emissions Study found

an increase in respiratory disease and symptoms in the study population. Changes in lung function (spirometric changes) consistent with increased particulates were also demonstrated, although the changes were not statistically significant. There was no evidence of increased exposure to metals or of kidney problems associated with contaminants from the phosphate plants. (ATSDR 1995).

Between 1991 and 1997, the EPA conducted a Remedial Investigation and Feasibility Study (RI/FS) to determine the nature and extent of site contamination at EMF. Groundwater, surface water, sediment and soil samples were collected. The RI/FS was completed and a proposed plan for cleanup was released in April 1997. The Record of Decision (ROD) was issued on June 8, 1998, requiring capping of contaminated soils, environmental monitoring, and institutional controls.

In March 1997, ATSDR completed a Site-Review and Update outlining their intended activities at the site. These activities included a re-evaluation of human exposure pathways associated with the site (specifically the development of health consultations that address the potential for past, present, and future human exposure to site-related contaminants in groundwater, surface water and sediment, surface soil, biota, and ambient air). As outlined in the Site-Review and Update, ATSDR released health consultations for surface soil, surface water/sediments, and groundwater (ATSDR 1998a, 1998b, 1998c) in October 1998 based on data generated by the RI/FS.

During the development of these health consultations, ATSDR, EPA, BCEH, the Idaho Southeastern District Health Department (SDHD), tribal officials, and local officials worked with community members to identify site-related health concerns and health education needs. ATSDR conducted an environmental health information needs assessment among impacted community members and the health professionals serving them. ATSDR and BCEH then developed and implemented health education activities designed to address the needs and concerns identified by the community. Results of the health consultations were presented by ATSDR and BCEH at public meetings in both Fort Hall and Pocatello.

In response to concerns from members of the Shoshone-Bannock Tribes and the non-tribal community, ATSDR finalized a health consultation in March 2001 which evaluated current and historical exposures to air pollutants. This health consultation concluded that the release of air contaminants from the site and other sources posed a public health hazard to residents of Chubbuck, Pocatello, and the Fort Hall Indian Reservation (ATSDR 2001). ATSDR recommended continued air monitoring in the EMF area and a reduction in air pollution emissions.

As a result of the evaluation of air exposures, ATSDR agreed to conduct a study on the impact of air pollution on the cardiopulmonary and respiratory health of people who reside in Pocatello and Chubbuck. To this end, ATSDR developed a peer-reviewed protocol for the health study and has begun evaluating hospital admissions data from the Portneuf Regional Medical Center and the former Pocatello Regional Medical Center (owned by Intermountain Hospital Corporation). The Shoshone-Bannock Tribes are also conducting a health study in conjunction with FMC and independent experts at Oregon Health Sciences University to investigate the impacts of air

pollution on the health of Native Americans on the Fort Hall Reservation. Both studies are currently underway.

Since the previous health consultations were released, there have been a number of significant changes at the EMF site. In December 2001, FMC ceased production and initiated activities to decommission the facility. As a result, air emissions related to the FMC facility operations ceased with the exception of minor sources related to decommissioning activities (EPA 2003) and fugitive dust. In August 2002, FMC terminated its industrial wastewater discharge to the Portneuf River and the EPA subsequently terminated FMC's National Pollutant Discharge Elimination System (NPDES) work permit. A number of active surface impoundment ponds have been closed since 1998, which should result in a reduction of migration of contaminants to the aquifers. All of the RCRA-regulated ponds at FMC are currently closed or in closure.

According to the J.R. Simplot Company, improvements made at the facility in 2001 resulted in a decrease in sulfur dioxide emissions. Other emission reductions include the shutdown of the ammonia and nitric acid plants in 2002, which reduced emissions of nitrogen oxides by about 263 tons per year and ammonia emissions by nearly 188 tons per year.

In October 2003, the EPA and FMC entered into an Administrative Order on Consent (AOC) for Supplemental Remedial Investigation and Feasibility Study (Supplemental RI/FS) at the FMC Plant Operable Unit. The AOC outlines the process and schedule for conducting an investigation of the former operating areas. The Supplemental RI/FS will include constituents that did not have toxicity data at the time the original RI was conducted, such as elemental phosphorus and radium 226. The additional investigation is expected to be completed by summer of 2006.

In conjunction with ATSDR, BCEH conducted this comprehensive public health assessment for the EMF site. This public health assessment was prepared in light of changes in site operations, and new environmental data, health information and community health concerns. BCEH reviewed past ATSDR health consultations (ATSDR 1998a, 1998b, 1998c, 2001) and revisited the conclusions and recommendations made in these health consultations in the context of this new data and information. In addition, in response to community concerns, BCEH and CDRI conducted a cancer incidence analysis for residents of Chubbuck, Pocatello and Fort Hall.

2.3 Land Use

According to the RI/FS Report (Bechtel 1996), the EMF site includes land belonging to the FMC, Simplot, Fort Hall Indian Reservation, the Bureau of Land Management (BLM), Bannock and Power Counties, and portions of the cities of Pocatello and Chubbuck. Land use on the Fort Hall Indian Reservation in the area surrounding the EMF site is mainly agricultural with scattered residences. BLM land in the area is designated for multiple uses. Unincorporated land in Bannock and Power Counties is mostly agricultural, also with scattered residences, and land within the cities of Pocatello and Chubbuck in the EMF area is primarily zoned for residential use.

In addition to owning the land on which the facilities operate, FMC and Simplot also own all land (with the exception of road rights-of-way) between the facilities and Interstate 86, as well as

substantial property located immediately north of Interstate 86 and east of the facilities. Other land uses in the area included a drag racing strip (which has closed) located across the access road from FMC and a park across the street from Simplot. Until March 12, 1995, the Bannock Paving Company (BAPCO) operated a paving and aggregate handling facility on land leased from, and adjacent to, the FMC facility. BAPCO periodically conducted many industrial operations at this site, such as processing asphalt, drying coke, and crushing slag and ferrophosphate (Bechtel 1996). The land owned by FMC to the north of the facility is reportedly deed restricted, prohibiting current or potential future residential use. All of the FMC property to the north of Interstate 86 is fenced with locked gates and posted with no trespassing signs. The number of people who access the land immediately north of FMC is believed to be limited, but passers by clearly use the area (ATSDR 2001).

2.4 Demographics

The area within a one-mile radius of the FMC and Simplot facilities is sparsely populated with approximately 220 residents, as is typical of areas with primarily agricultural and industrial land uses (See appendix A, Figure A-3-Demographics map). Several residences and businesses have been observed within one mile of the site, including a trailer park located one mile to the east of the site (Appendix A, Figure A-3). The nearest major population areas, the cities of Pocatello and Chubbuck, Idaho, are located east-southeast and east-northeast, respectively, of the FMC and Simplot facilities (see Appendix A, Figure A-1). Based on the 2000 U.S. Census, the combined populations of these two cities was 61,166 residents. The area within a five-mile radius of the facilities includes much of the cities of Chubbuck and Pocatello, as well as a larger portion of the Fort Hall Indian Reservation. As a result, the area within five miles of the facilities is considerably more populated than the area within just one mile of the facilities. The nearest populated area on the Fort Hall Indian Reservation, the Fort Hall Agency, is located about eight miles north-northeast of the facilities. However, the majority of the population on the Fort Hall Indian Reservation lives in rural areas, including some within one mile of FMC and Simplot.

3. DISCUSSION

3.1 Data and Information Used

The data evaluated in this document came from the following sources: EPA Report for the EMF Site (Bechtel 1993, 1994, 1995, 1996), RCRA Pond Emission Study (Bechtel 1998), OP-FTIR Air Monitoring System Quarterly Report (FMC 1999a, 1999b, 1999c, 1999d, 2000), Portneuf Valley Particulate Matter Air Quality Improvement Plan (IDEQ 1999), Fort Hall Source Apportionment Study (EPA 1999a), as well as the air monitoring data for the Pocatello area from IDEQ (IDEQ 2003, 2004b), Quarterly Report of the Shoshone-Bannock/EPA Particulate Monitoring Program (Sho-Ban 2004), Supplemental Remedial Investigation and Feasibility Study (RI/FS) Statement of Work (EPA 2003); Evaluation of Water Quality Impacts Associated with FMC and Simplot Phosphate Ore Processing Facilities (IDEQ 2004a); groundwater monitoring data for EMF area from EPA (Meyer 2004); the NPDES Discharge Monitoring Report (FMC 2002); and the Elemental Phosphorus Slag Exposure Study – Phase I Final Report (FMC et al. 1999).

The conclusions reached in this document are based on the data available at this time, a review of previous ATSDR health consultations, information obtained from site visits, community concerns, and public and agency input. Conclusions may be modified based on additional data and information.

3.2 Evaluation Process

3.2.1. Past Health Consultations and New Information

The general process by which ATSDR (in previous health consultations) and BCEH (in this public health assessment) evaluate the possible health impacts of environmental contaminants is summarized here and described in more detail in Appendix D. The first step involves screening the available data for contaminants of concern (COCs). BCEH uses conservative comparison values (CVs) to determine which chemicals to examine more closely. CVs are concentrations of chemicals in the environment (air, water, or soil) below which no adverse human health effects should occur. Exceeding a CV does not mean that health effects will occur, just that more evaluation is needed. BCEH then examines environmental and human components that might constitute a human exposure pathway and lead to contact with COCs in the past, present, or future. It is important to note that a complete exposure pathway does not necessarily imply that negative health effects will occur. BCEH also reviews site history, information on site activities, and the available sampling data to identify exposure pathways that warrant consideration. The next step is to take those contaminants that are above the CVs and further identify which chemicals and exposure situations are likely to be a health hazard. The public health implications of contamination in air, surface soil, surface water and sediments, groundwater, and biota are discussed in a later section of this public health assessment.

For a detailed account of the COCs identified in past health consultations, see Appendices F, G, H, and I. Additional information regarding the exposure pathways identified for the EMF site is provided in Appendix E of this public health assessment.
For this public health assessment, BCEH reviewed the past health consultations for surface soil, surface water and sediment, groundwater, and air health consultations (Appendices F- I.), summarized the major findings and, when available, reviewed and discussed new information and/or environmental data which were not previously addressed. Based on the new information and/or environmental data, BCEH will discuss any changes in previously identified exposure pathways and public health implications.

3.2.2 Radiological Contamination in Air

For radiological contamination in the air, BCEH first reviewed available radiological data to identify the contaminants of concern and completed exposure pathways. BCEH reviewed radiological air data collected in and around the EMF area. The contaminants considered in this section are the radioisotopes released by FMC and Simplot. When radioisotopes decay, they can release ionizing radiation which is a type of electromagnetic or particulate energy. This energy is what determines the health effects associated with radioisotope contamination. BCEH then calculated the estimated radiological doses to targeted organs using the most conservative parameters. Doses are calculated for the site-specific exposure scenarios using assumptions

regarding who comes in contact with the COCs, how often they are exposed, and how much contaminant they encounter. The public health implications of radiological contamination in air are discussed in a later section of this public health assessment.

3.3 Exposure Pathways and Public Health Implications

3.3.1 Surface Soil Ingestion Pathway

ATSDR released a health consultation for surface soil contamination at the EMF site in 1998 which evaluated soil data generated during the RI/FS (Bechtel 1996). Tables in Appendix F present the maximum contaminant concentrations measured during the RI. No new surface soil data has been generated since the health consultation was released.

In the previous health consultation for soil contamination, cadmium was the contaminant of concern for both FMC workers and the general public. ATSDR concluded that it was very unlikely that children or the general public would come in contact with site-related surface soil contamination for a sufficient amount of time to result in adverse health effects. However, following the release of the health consultation, ATSDR's environmental media evaluation guide (EMEG) for cadmium in surface soil was re-evaluated and lowered from 500 mg/kg to 100 mg/kg. Despite the reduction in the EMEG, ATSDR's conclusion that exposure to contaminants in soil is unlikely to pose a health risk to the general public and children still remains viable.

While evaluating the health risks posed to community members in previous health consultations, ATSDR also looked at health risks posed to workers at both the FMC and Simplot facilities. At the time, the site was classified as a public health hazard given the potential for workers to be exposed to site-related contaminants in surface soil and the potential for adverse health effects to occur in exposed workers. The main findings of the previous health consultation were that 1) workers at the FMC facility may be exposed to cadmium contaminated surface soil, 2) these exposures may increase the potential for the workers who smoke to develop proteinuria (proteins found in urine because of damage to the kidneys), and 3) slag and gypsum pile workers at both facilities may be exposed to elevated levels of alpha, beta, and gamma radiation, which could increase their risk of developing cancer (ATSDR 1998a, Appendix F).

Since the release of the health consultation, in December 2001, FMC ceased production of elemental phosphorous from phosphate ore at its facility and began decommissioning activities (EPA 2003). As a result, workers are no longer employed at the FMC site, with the exception of some contractors engaged in decommissioning, dismantling and remediation work. All workers at the plant site must comply with FMC's health and safety procedures and task specific health and safety plans, which are in compliance with Occupational Health and Safety Administration (OSHA) standards. Therefore, worker exposure to contaminants in soil and slag are no longer occurring. However, gypsum stack workers in the Simplot facility may presently be exposed to elevated levels of alpha, beta, and gamma radiation, as well as possible radon emissions from the phosphogypsum stack.

According to ATSDR (1998a), depending on work practices, the amount of dust generated, personal protective devices used, and personal hygiene habits, some workers may inhale or

ingest surface soil containing elevated gross alpha, beta and gamma radiation. Work practices at the Simplot facility have not changed significantly since 1998 therefore, as concluded in the prior health consultation radiation exposure may be occurring for gypsum stack workers and may increase their cancer risk. Because phosphogypsum waste materials at the Simplot facility are handled via mechanical means (i.e., slurry pipeline and front-end loaders with enclosed cabs), radiation exposure for a few workers near the gypsum stack is significantly reduced. Current worker exposures could be reduced further by the implementation and continuation of good occupational practices (e.g., shielding provided by vehicles and dust control), thereby significantly reducing the workers' risk of developing cancer. The Simplot Consent Decree Scope of Work requires Simplot to implement institutional controls and monitor gypsum stack worker exposure to radiation. The controls outlined in the Consent Decree include 1) training to inform workers of potential health hazards associated with the site, 2) measures to mitigate radiation exposure, 3) identification of areas with elevated gross alpha levels in soil, and 4) implementation of radon controls and monitoring. Simplot has submitted an institutional controls program plan which is currently under review by the EPA, IDEQ, and the Shoshone Bannock Tribes.

3.3.2 Surface Water/Sediment Exposure Pathway

ATSDR released a health consultation for surface water and sediment contamination at the EMF contamination site in 1998 based on data generated during the RI/FS (Bechtel 1996). Tables in Appendix G present maximum contaminant concentrations found during initial surface water and sediment sampling and analysis. The previous health consultation classified surface water and sediment as posing no apparent public health hazard. It concluded that it is unlikely that FMC or Simplot workers, the general public, including children, have been, are currently, or will be exposed to significant levels of site-related surface water or sediments (ATSDR 1998b, Appendix G).

Since the health consultation, no additional sediment sampling has occurred. However, in 2003, IDEQ released a report containing limited water quality data taken at various transects in the Portneuf River near the EMF site. None of the site-related contaminants (phosphorus and nitrate) that were measured exceeded health-based comparison values. In addition, wastewater discharges from the FMC facility to the Portneuf River permanently ceased in 2002, which would likely have resulted in a reduction of site-related contaminants in surface water and sediments near the site. Therefore, the previous health consultation's conclusion of no apparent public health hazard is still applicable.

3.3.3 Groundwater Exposure Pathway

Based upon the various investigations, it has been determined that there are two separate aquifers (shallow and deep) underlying the EMF site (Bechtel 1996). The shallow aquifer is a 10 to 20-feet thick gravel and sand aquifer that is locally overlain by a silt aquitard. The deep aquifer is the gravel unit of the Sunbeam Formation and the underlying basalt and rhyolite. These two aquifers are separated by the American Falls Lake Beds aquitard. According to IDEQ, groundwater from the shallow and deep aquifers beneath the site discharge into the Portneuf River at the Batiste and Swanson Road Springs (Wicherski 2004).

Analysis of groundwater samples taken from the deep aquifer during the RI/FS indicates that no site-related contamination has entered the deep aquifer at levels of health concern (Bechtel 1996). However, analysis of groundwater samples taken from the shallow aquifer indicates that the activities at the two facilities have resulted in significant contamination of the shallow aquifer (Bechtel 1996).

Based on groundwater data generated during the RI/FS, ATSDR released a health consultation for groundwater contamination at the EMF contamination site in 1998 (ATSDR 1998c). Based on the past exposures to site-related contaminants (such as arsenic and nitrate/nitrite) in groundwater, the health consultation concluded that a public health hazard existed. However, the only locations at or near the EMF site that ever used contaminated shallow groundwater for human consumption are the Old Pilot Café well, the Frontier well, and the Batiste Spring. While these wells and spring are no longer used for drinking water, people may have been exposed to contaminated drinking water from these sources in the past.

It was determined that long term (greater than a year) employees at the Old Pilot Café (prior to 1976) and the Frontier Building (prior to the late 1980's) may be at higher risk of developing skin, liver, bladder, and kidney cancers if they drank a significant amount of water at work due to elevated arsenic concentrations in the drinking water. These same people may also have lower production of red and white blood cells, abnormal heart rhythm, and blood-vessel damage (e.g., Raynaud's disease and cyanosis of fingers and toes). It was also concluded that if an infant (less than four months of age) was fed formula made with water from the Old Pilot Café well (prior to 1976) or the Batiste Spring for several days, the infant would have had an increased risk of developing acute acquired methemoglobinemia ("blue baby syndrome") due to elevated nitrate/nitrite concentrations in the drinking water (ATSDR 1998c, Appendix H).

In the previous health consultation, the Meadow Gold Dairy spring was identified as a drinking water source. Until May 2004, the Dairy bottled the spring water, which was regulated by the Food and Drug Administration, and sold it in local grocery stores. (For testing requirements for bottled water, see the Code of Federal Register, 21 CFR 165.110 Subpart B). At the time of the health consultation, water from the Meadow Gold Dairy spring did not exceed health-based comparison values for any site-related contaminants. Since then, the spring water has not exceeded the maximum contaminant levels (MCL) for site-related contaminants, including nitrate most recently sampled in 2003.

As a result of the past groundwater health consultation, ATSDR recommended that appropriate monitoring of the groundwater (e.g., quarterly monitoring of monitoring wells 524 and 525 between Batiste Spring and Meadow Gold Dairy Spring) should be conducted to assure that site-related contaminants do not impact drinking water sources and that appropriate remedial actions be instituted or continued to prevent future migration of site-related groundwater contaminants into additional drinking water sources (e.g., the Meadow Gold Dairy spring) (ATSDR 1998c, Appendix H). Since the release of the health consultation, wells 524 and 525 have been monitored on at least a yearly basis. The maximum concentrations of site-related groundwater contaminants (arsenic, nitrate, selenium and sulfate) found in monitoring wells 524 and 525

between 1994 and 2003 are summarized in Table B-1 (Appendix B). None of these site-related contaminants exceeded the health-based comparison values.

While conducting this health assessment, it was brought to BCEH's attention that Simplot has three production wells (Well 4, Well 5, and Well 7) located on its property which are identified as public drinking water wells and are subject to monitoring requirements for public drinking water wells. Sample results of one of these wells showed arsenic concentrations in 1993 and 2003 of 0.03 mg/L and 0.054 mg/L respectively (both above the MCL of 0.01 mg/L). However, no one is currently drinking water from these wells, which has been confirmed by both the Southeastern District Health Department and the J.R. Simplot Company. Simplot supplies bottled drinking water for its onsite employees. The majority of the water from these wells is used for processing water and the remainder supplies safety showers, eye washes, hand washing sinks, showers, and toilets.

Currently no one is being exposed to site-related contaminated drinking water. Therefore, at present, the groundwater exposure pathway is an eliminated exposure pathway, and it is unlikely to result in any adverse health effects.

3.3.4 Air Exposure Pathway

3.3.4.1 Non-Radiological Contamination in Air

In 2001, ATSDR released a health consultation which evaluated air exposures to particulate matter smaller than 10 microns in diameter (PM10) and particulate matter smaller than 2.5 microns in diameter (PM2.5) at the EMF site (ATSDR 2001, Appendix I). Based on ambient air monitoring data collected between 1975 to 1999, ATSDR concluded that a public health hazard had existed since at least 1975 and would continue to exist in the future unless particulate matter emissions from two phosphate processing plants (FMC and Simplot) and from other sources (such as paved roads, windblown dust, fires and residential heating) were reduced. The primary finding of the report was that persons in the cities of Chubbuck and Pocatello were exposed to short- and long-term levels of PM10 and PM2.5 between 1975 and 1999 that may result in adverse cardiopulmonary health effects. The health consultation also noted that long-term average concentrations and the frequency of 24-hour concentrations of PM2.5 and PM10 in excess of the health-based comparison value had dropped appreciably since 1993 (ATSDR 2001, Appendix I).

Since the release of the health consultation, FMC stopped production and initiated activities to decommission the facility. As a result, in December 2001 air emissions related to facility operations ceased with the exception of minor sources related to decommissioning activities and fugitive dust. EPA estimated FMC's PM-10 emissions inventory to be 1,532 tons per year before control technologies were employed at the plant and 424 tons per year after controls were in put in place (EPA 2000). FMC began implementing control technologies in 1998 resulting in a continuous reduction in PM10 emissions from the facility until closure in 2001. After the closure of FMC, the total emissions of particulate matter from the site and resulting PM concentrations decreased appreciably. It is estimated that Simplot emits 135 tons of particulate matter to the air per year (IDEQ 1999).

At the time the previous health consultation was released, available data was limited to air monitoring that occurred before 2000. Since then, IDEQ and the Shoshone-Bannock Tribes have collected additional air monitoring data in the EMF area.

New air monitoring data from IDEQ: The IDEQ air monitoring network consists of 4 stations; Garret and Gould, Pocatello Sewage Treatment Plant, Chubbuck School, and Idaho State University (Figure A-1, Appendix A). From 2000 to 2003, IDEQ monitored PM10 and PM2.5 at the Garret and Gould station, PM10 at the Pocatello Sewage Treatment Plant station, and PM2.5 at the Chubbuck School station. The Idaho State University PM10 monitor stopped operating in May 1999, followed by the Chubbuck School PM10 station in June 1999 and the Pocatello Sewage Treatment Plant PM10 station in June 2002. The Chubbuck School PM2.5 monitor was shut down in July 2003. Currently, the Garret and Gould station maintains the only active PM10 and PM2.5 monitors. Tables B-2 and B-3 (Appendix B) summarize the PM10 and PM2.5 data collected by IDEQ from 2000 to 2004 (IDEQ 2004b).

Annual average PM10 concentrations measured at the Pocatello Sewage Treatment Plant station between 2000 and 2001 and at the Garret and Gould station between 2000 and 2003 did not exceed EPA's health-based comparison value (50 microgram per cubic meter, $\mu g/m^3$). Annual average PM10 concentrations from 2000 and 2003 are similar to those between 1995 and 1999. The 24-hour average PM10 concentrations measured at the Pocatello Sewage Treatment Plant and Garret and Gould stations have not exceeded the health-based comparison value (150 $\mu g/m^3$) since 2000.

Since 2000, 24-hour average PM2.5 concentrations exceeded EPA's health-based comparison value (65 $\mu g/m^3$) only once on February 6, 2000 (72.7 $\mu g/m^3$) (Table B-3, Appendix B). From 2000 to 2004, the annual average PM2.5 levels have not exceeded EPA's health-based comparison value (15 $\mu g/m^3$).

Between January 2001 and August 2002, IDEQ analyzed eleven samples with high PM values for selected metals and other inorganics (including ammonium ions, nitrate ions, fluoride ions, chloride ions, and sulfate ions) (IDEQ 2003). These samples were collected at the Garrett and Gould Site in Pocatello. During this period, arsenic, cadmium, and chromium (total) were measured at levels exceeding their corresponding health-based comparison values on at least one occasion. The maximum 24-hour air concentrations of arsenic, cadmium and chromium were 0.0015, 0.0077 and 0.0017 ($\mu g/m^3$) respectively, which are all lower than the levels reported in the health consultation, *Air Contamination at the Eastern Michaud Flats* (ATSDR 2001, Appendix I). As discussed in the health consultation (ATSDR 2001, Appendix I), adverse health effects are not expected from exposure to metals in the air at these concentrations.

IDEQ has also continued to measure ambient air concentrations of sulfur dioxide at the Pocatello Sewage Treatment Plant. The data from 1999 to 2003 (Table B-4, Appendix B) shows that the annual average concentrations are all below EPA's health-based comparison value (0.03 parts per million, ppm). Since 1999, the maximum 24-hour average sulfur dioxide concentration remained below EPA's health-based comparison value of 0.14 ppm. Therefore, sulfur dioxide in ambient air is unlikely to result in any adverse health effects.

New air monitoring data from Shoshone-Bannock Tribes: The Shoshone-Bannock Tribes have four ambient air monitoring stations; the Primary, Sho-Ban, Ballard, and Fort Hall stations (Figure A-1 and A-4, Appendix A). From 2000 to 2003, the Tribes monitored PM10 at both the Primary and Sho-Ban Station. In addition, the Tribes began monitoring PM10 at the Fort Hall station in March 2000 and at the Ballard station in December 2001. PM2.5 monitoring at the Primary Station started in April 2000. The Sho-Ban and Ballard stations discontinued PM10 monitoring in March 2003. Currently the Fort Hall PM10 monitor and the Primary station PM10 and PM2.5 monitors are active. Air monitoring data for PM10 and PM2.5 collected by Shoshone-Bannock Tribes between 2000 and 2003 (Sho-Ban 2004) is listed in Table B-5 and Table B-6 (Appendix B).

In 2000, annual average PM10 concentrations at Primary Station (57.8 $\mu g/m^3$) and Sho-Ban Station (49.5 $\mu g/m^3$) were either above or close to EPA's health-based comparison value (50 $\mu g/m^3$). Since 2000, annual average PM10 concentrations have been decreasing steadily and have not exceeded EPA's health-based comparison value. The 24-hour average PM10 concentrations exceeded EPA's health-based comparison value (150 $\mu g/m^3$) three times in 2000 (187.5, 183, 167.6 $\mu g/m^3$ at the Primary Station, 250.7, 220.8, 179 $\mu g/m^3$ at the Sho-Ban Station) and once in 2002 at both the Primary Station and Sho-Ban Station (214.1 $\mu g/m^3$ and 202.9 $\mu g/m^3$ respectively). No exceedances occurred in 2001 and 2003.

At the Fort Hall Station, there was only one exceedance of EPA's health-based comparison value (150 $\mu g/m^3$). On August 11, 2001, 24-hour average PM10 concentrations reached 168.9 $\mu g/m^3$. There have been no exceedances at the Ballard Station.

At the Primary Station, there have been no PM2.5 exceedances. In 2003, annual average and maximum 24-hour PM2.5 concentrations were as low as 7.6 $\mu g/m^3$ and 22.7 $\mu g/m^3$ respectively (Table B-6, Appendix B). However, it is still possible that during occasional winter inversion conditions, 24-hour average PM2.5 concentrations may come close to EPA's comparison value (65 $\mu g/m^3$), such as occurred on January 16, 2004 when the 24-hour average PM2.5 concentration reached 49.0 $\mu g/m^3$ (Turner 2004).

How do ATSDR's and EPA's roles differ in evaluating air quality criteria?

When reading this health assessment document, it is important to note that BCEH and ATSDR's roles at the EMF site as public health agencies are considerably different from the roles of other agencies, particularly those charged with addressing environmental issues. In this document, BCEH evaluates the public health implications of the levels of air pollution in the EMF area. These evaluations are not meant to address the region's compliance, or lack thereof, with state and federal environmental standards, such as EPA's National Ambient Air Quality Standards (NAAQS), even though this health assessment uses the NAAQS as a means for evaluating air monitoring data collected at the EMF site.

Throughout this report, BCEH uses EPA's current health-based national ambient air quality standards (NAAQS) to evaluate the public health implications of measured concentrations of particulate matter. BCEH compares the measured levels of air pollution to EPA's health-based standards as a first step in evaluating public health implications of the levels of air pollution. Additionally, BCEH considers the potential for human exposure to air of poor quality and, in this report, does not consider EPA's criteria for compliance or attainment. Therefore, this report's findings must not be confused with EPA's evaluation of attainment for the region.

Air Quality in Chubbuck and Pocatello: Between 2000 and 2003, 24-hour average concentrations of PM2.5 exceeded the health-based comparison value (65 $\mu g/m^3$) only once, on February 6, 2000 (72.7 $\mu g/m^3$). Twenty-four hour and annual average concentrations of PM10, as well as the annual average concentrations of PM2.5 are all below their respective health-based comparison values. These data suggest that PM10 and PM2.5 are ***no longer a public health hazard*** in the Chubbuck and Pocatello area ***at present***. However, this does not guarantee that unhealthy levels of PM10 and PM2.5 (those exceeding their respective 24-hour average health-based comparison values of 150 $\mu g/m^3$ and 65 $\mu g/m^3$) will not occur in severe inversion-producing conditions in the future.

The maximum 24-hour air concentrations of arsenic, cadmium and chromium between 2001 and 2002 were at levels exceeding their corresponding health-based comparison values on at least one occasion. However, they were all lower than those reported in the previous health consultation for air. As discussed in the health consultation (Appendix I), the concentrations of individual metals were well below levels in the scientific literature that showed non-carcinogenic health effects in humans and animals. Therefore, the conclusion that it is unlikely that adverse non-carcinogenic health effects would result from short-term exposure to the individual metal is still applicable.

BCEH evaluates carcinogenic health effects based on long-term exposures to cancer-causing agents. Due to the limited number of samples analyzed for metals between 2001 and 2002 (n=11), annual averages could not be calculated. For this reason, BCEH was not able to evaluate the potential for carcinogenic health effects to occur based on the new metals data. As mentioned previously, maximum 24-hour metal concentrations in air were below those reported in the past health consultation. With this in mind, BCEH believes that the conclusion for the carcinogenic

health effects in the previous health consultation (ATSDR 2001) is still applicable, and that the concentration of metals is not likely to result in an appreciable increased risk of cancer in the exposed population.

What is a nonattainment area?

In 1970, the Clean Air Act established requirements for the attainment and maintenance of National Ambient Air Quality Standards (NAAQS). These standards, which are set by the EPA, cover six criteria air pollutants, including ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, lead and particulate matter. EPA calls these pollutants criteria air pollutants because they regulate them by first developing health-based criteria as the basis for setting allowable levels. A geographic area that meets or does better than the NAAQS is called an "attainment" area. Areas that don't meet air quality standards are called "nonattainment" areas.

An area is given nonattainment status when a NAAQS is violated. A violation occurs when air pollution levels exceed the average 24-hour standard more than three times in any three year period. Therefore, a region can have up to three days of poor air quality in a row and still remain in attainment status, if no other exceedances occurred in the previous three years.

Why was the Portneuf Valley designated a nonattainment area?

In 1990, the Clean Air Act was amended to require the EPA to designate all areas exceeding or having potential to exceed the PM_{10} standards prior to January 1, 1989 as Nonattainment Areas (NAA's). As a result, the Cities of Pocatello, Chubbuck, and Inkom, as well as a portion of the Fort Hall Indian Reservation, were designated as the Portneuf Valley PM_{10} Nonattainment Area (PVNAA).

The Portneuf Valley has been in attainment of the PM_{10} NAAQS since December 31, 1996, and with the exception of three days during a severe winter inversion in December 1999, the PM_{10} 24-hour standard has not been exceeded since 1994. Exceedance of the PM10 standard during the 1999 inversion did not register as a violation of the standard since no other exceedances occurred prior to December 31, 2001.

In 2004, IDEQ completed the Portneuf Valley PM_{10} Nonattainment Area (PVNAA) State Implementation Plan (SIP), Maintenance Plan, and Redesignation Request. This document demonstrates all Clean Air Act requirements for attainment have been met, summarizes the progress of the area in attaining the annual and 24-hour PM_{10} standards, and includes a maintenance plan to ensure continued attainment.

Air Quality on the Fort Hall Indian Reservation: Air monitoring data collected by the Shoshone-Bannock Tribes at Sho-Ban and Primary Stations (which are the closest stations to the FMC facility) consistently showed the highest levels of PM10 in the entire EMF area before FMC ceased air emission in December 2001. Since then, 24-hour PM10 concentrations exceeded the health-based comparison value of 150 $\mu g/m^3$ only once on April 23, 2002 (214.1 $\mu g/m^3$ at

Primary Station, and 202.9 μg/m^3 at Sho-Ban Station). Furthermore, annual average PM10 and PM2.5 concentrations and 24-hour PM2.5 concentrations have not exceeded EPA's health-based comparison values since 2000. PM10 data collected at the Ballard Station has never exceeded EPA's health-based comparison values. As with Chubbuck and Pocatello, these data suggest that PM10 and PM2.5 are ***no longer a public health hazard*** on the Fort Hall Indian Reservation ***at present***. However, this does not guarantee that unhealthy levels of PM10 and PM2.5 will not occur in severe inversion-producing conditions in the future.

3.3.4.2 Radiological Contamination in Air

This section reviews and discusses the radiological implications of air releases from both the FMC and Simplot operations.

The Simplot facility currently uses a wet process to produce phosphoric acid and prior to decommissioning, the FMC facility used a thermal process to produce elemental phosphorus. Both of these processes release radiological materials as by-products to the environment through air emissions and fugitive release from slag and gypsum piles. Radionuclide emissions from FMC and radon emissions from Simplot's phosphogypsum stack are regulated by the National Emission Standards for Hazardous Air Pollutants (40 CFR 61). These regulations have been in place since 1989 and limit emissions to levels that correspond to an excess cancer risk of less than one in ten thousand over a lifetime. Radiological materials released from the site include thorium 232 (Th 232), radium 226 (Ra 226), uranium isotopes (U 238, U 235, and U 234), polonium 210 (Po 210), lead 210 (Pb 210), radon 222 (Rn 222), and other components of the natural decay scheme for which the uranium or Th 232 is the initial source.

The radiological data used in this section were derived from a seven station air monitoring network running from October through December 1993 (Bechtel 1994). This network measured both PM10 and radionuclide concentrations. Air filters used to measure particulates in the air (PM10) were also analyzed for radionuclides. Radionuclide levels measured in air are given in Table B-7 (Appendix B). Background values in Table B-7 were collected near the Pocatello airport.

Public health implications: Human health risks associated with exposure to airborne contaminants is dependent on the contaminant concentration, duration of exposure, and inhalation rate. The radiological dose delivered to target organs (including the lungs) is also dependent on the chemical form, solubility and the resulting internal dose. In the case of the radionuclides released at the EMF site, BCEH believes the organs most likely impacted by these air releases are the lungs, bone red marrow, where the majority of the blood cell production occurs, or perhaps bone surfaces. For the purposes of calculating radiation dose to the bone, some radionuclides concentrate along the surface of the bone and other radionuclides are distributed throughout the entire bone irradiating the red marrow.

BCEH calculated estimated radiological doses to the lung and either bone surfaces or the bone red marrow. To estimate the radiological dose, BCEH used the maximum concentrations of contaminants found in air samples, inhalation rates supplied in the EPA Exposure Factors Handbook (EPA 1999b), and radiological dose conversion factors set by the International

Commission on Radiological Protection (ICRP 1995; ICRP 1996). The results of these calculations are supplied in Table B-8 (Appendix B) (Charp 2004).

Results in Table B-8 (Appendix B) show that the estimated radiological doses to organs of concern are similar to doses one might receive from background radiation levels throughout the country. In addition, based on estimates from the National Research Council (NRC) (NRC 1990), the radiological dose to the bone surface resulting from air emissions at EMF are not expected to result in any adverse bone cancers.

It has been shown in past studies that radiation dose delivered to the bone marrow could result in several blood-related illnesses such as myeloid and lymphatic leukemia (NRC 1990), which may also be age-related (NCRP 1993). However, little information exists to show how much radiation exposure is needed to cause leukemia. The only comparative studies available show that leukemia appeared shortly after ingestion of radium by radium dial painters. However, this study was deemed inconclusive in a review of U.S. studies of radium exposures in humans (Rowland 1994). Based on radionuclide concentrations in air, the estimated radiological dose to the bone red marrow around EMF (7 millirem) is about 5,800 times lower than the lowest dose estimated in the entire group of radium dial painters (40 rem). Therefore, it is unlikely that any adverse health effects related to blood-related illness would be expected in individuals living around the EMF site.

Inhaled radioactive materials can also affect the lungs. However, the estimated radiation dose to the lungs of residents around the EMF facility (around 100 millirem per year) is similar to the dose from the inhalation of radon gas for a typical individual anywhere in the country. In comparison, the average whole body dose from radon exposure in the U.S. population is 200 millirem per year with the majority of this dose being delivered directly to the lung and its structures (NCRP 1987). Therefore, it is unlikely that any adverse health outcomes related to lung cancer would be expected in individuals living around the EMF site.

BCEH does not believe that any adverse health effects exist as a result of radiological emissions to the atmosphere during the period of time covered by the available data. BCEH is uncertain about the exposures that could have resulted during those periods of time when air emissions were much different from the period for which the data exist.

3.3.5 Residential Exposures to Radiation from Slag

Elemental phosphorus slag is a byproduct of elemental phosphorus production. Phosphorus slag contains natural radioactive material at levels higher than found in most ordinary rock and soil. This radioactive material emits gamma radiation which is a type of radiation similar to medical x-rays.

Until 1990, the slag generated by the FMC process was used for construction purposes as aggregate in concrete and asphalt, roadbed fill, backfill, streets, sidewalks and railroad ballast. In the 1950s until 1976, it was also used in concrete poured for some basements and building foundations. In 1976, the State of Idaho prohibited the use of slag for residential construction.

Immediately thereafter, FMC voluntarily suspended the use of slag in the construction of all inhabited buildings.

In May 1990, the EPA issued a report on the Idaho Radionuclide Study (EPA 1990). The study concluded that some citizens in Pocatello could be at increased risk of contracting cancer because of long-term exposure to low-level radiation from slag in building foundations, streets, and sidewalks. Following the release of the Idaho Radionuclide Study (EPA 1990), FMC voluntarily suspended the sale of slag for all construction uses.

The primary public health concern from elemental phosphorus slag is gamma radiation emitted from the radionuclides present in the waste. This radiation can exceed ordinary background levels, particularly when slag is used in bulk, such as in construction. Radiation surveys in the southeast Idaho communities have demonstrated that the use of slag has resulted in increased levels of radiation in public areas as well as residences. The exposure pathway of concern is direct exposure which means that exposure is related to a person's proximity to the material.

Since 1996, FMC has been conducting a radiation exposure study to assess dose to individuals from exposure to gamma radiation from phosphorus slag. This exposure study is being conducted according to an AOC between EPA and FMC. The guidelines, methods, and action levels for this study were developed by a technical work group that consisted of representatives of the Shoshone-Bannock Tribes, FMC, Monsanto, State of Idaho, Communities of Pocatello and Soda Springs, and ATSDR. The exposure study offers individuals exposed to radiation from slag in the environment the opportunity to evaluate the extent of their individual exposure levels.

The most recent available data are from Elemental Phosphorus Slag Exposure Study-Phase I Final Report (FMC et al, 1999). Over a thousand residences participated in the study; 1133 were located in Pocatello and 204 were on the Fort Hall Reservation. No houses in Pocatello or Fort Hall were found to have slag in the construction and the Slag Exposure Study estimated that less than 0.5% of residences in these two communities might contain slag. Twenty-one residences in Pocatello and Fort Hall with maximum direct radiation equal to or exceeding the action level of 20 microrem per hour, or individual annual doses in excess of 100 millirem (mrem), as determined by thermoluminescent dosimeters (TLDs), were identified and recommended for a follow-up evaluation after an initial screening. Only two households (eight individuals) completed the follow-up surveys as of November 1, 1998. All other participating households were either no longer interested or withdrew from the study. Dose estimates based on measured radiation levels and time logs provided by residents were performed during follow-up. The highest estimated annual dose from the follow-up surveys for Pocatello and Fort Hall was 20.4 mrem above background levels, which is not high enough to cause apparent adverse health effects. However, since most of the residences which were recommended for further evaluation did not complete the follow-up surveys, BCEH cannot accurately evaluate the health effects of exposure to the radiation from slag use in the communities at this time. The Slag Exposure Study is still ongoing, therefore BCEH will further evaluate slag exposure data when and if it becomes available. More information on the Slag Exposure Study is available on the EPA Region 10 website.

3.3.6 Fish Consumption Exposure Pathway

According to the Idaho Department of Fish and Game (IDFG), people harvest fish from the lower Portneuf River near the Meadow Gold Dairy at the inflow of several groundwater springs (including Batiste Springs and others). A completed exposure pathway exists for non-site related contaminants and a potential exposure pathway exists for site-related contaminants for individuals who consume fish from the Portneuf River. Those individuals could include sports fishers and their families and friends who share the caught fish.

Descriptive surveys of the river have been conducted over the years, but do not provide useful human exposure data. It is not known how much fish is caught for human consumption and there is no available information on site-related contaminant concentrations in edible fish near the site.

BCEH acknowledges that some of COCs found in the Portneuf River (such as arsenic and selenium) may bioaccumulate in fish tissue. Available surface water and sediment data show that the maximum concentrations of arsenic are well below EPA's human health criteria for allowable arsenic concentrations in surface water (50 ppb). (EPA recommends pollutant concentrations in water that are considered to ensure the safe consumption of fish living in that water. EPA's water quality criteria are based on data and scientific judgments on the relationships between pollutant concentrations and human health effects.) There are no human health criteria for allowable selenium concentrations in surface water, however available surface water and sediment data suggests that maximum concentrations of selenium are well below health comparison values for surface water (based on ingestion exposure pathways). Therefore, BCEH believes that site-related contaminants in fish from the Portneuf River are unlikely to pose a health risk to people who consume these fish infrequently.

The only fish tissue data available for the Portneuf River are for non-site related contaminants. In 1992 and 1994, the U.S. Geological Survey (USGS) analyzed PCBs (polychlorinated biphenyls) in Utah Sucker and Common Carp. Although PCBs are not site-related contaminants and Utah suckers are not eaten by the general public, average PCBs concentration in Utah suckers are high enough (690 microgram per kilogram wet weight) to justify further sampling of edible fish from the Portneuf River.

Due to elevated PCB levels and to confirm that site-related contaminants in fish will not pose a health risk to the general public, BCEH will work with Idaho Department of Fish and Game (IDFG) and the IDHW Bureau of Laboratories to analyze edible fish harvested from the Portneuf River for PCBs and heavy metals. BCEH will then evaluate possible health effects associated with fish consumed from the Portneuf River.

3.4 ATSDR Child Health Considerations

ATSDR recognizes that infants and children may be more vulnerable to exposures than adults in communities faced with contamination of their air, water, soil, or food. This vulnerability is a result of the following factors:

- Children are more likely to play outdoors and bring food into contaminated areas.
- Children are shorter, resulting in a greater likelihood of breathing dust, soil, and heavy vapors close to the ground.
- Children are smaller, have a faster breathing rate, and eat and drink more food and water per body weight than do adults, which results in higher doses of chemical exposure per body weight.
- The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages.
- Young children are more prone to put foreign objects (including soil) into their mouths and have frequent hand-to-mouth contact.

Because children depend completely on adults for risk identification and management decisions, BCEH and ATSDR are committed to evaluating their special interests at the site as part of the ATSDR Child Health Considerations.

As delineated in the discussions of different exposure pathways, the surface soil contamination, surface water contamination, sediment contamination and the radiation exposure from air contamination are highly unlikely to result in any adverse health effects to local residents, including children. However, in the past, if an infant (less than four months of age) was fed formula made with water from the Old Pilot Café well (prior to 1976) or the Batiste Spring for several days, the infant would have had an increased risk of developing acute acquired methemoglobinemia ("blue baby syndrome") due to elevated nitrate/nitrite concentrations in the drinking water. Children, especially those with pre-existing heart or lung disease or asthma, are one of the groups that probably have the greatest risk for suffering adverse health effects from the air contamination (ATSDR 2001).

3.5 Health Outcome Data (HOD) Evaluation

Because proteinuria (excess proteins found in the urine because of damage to the kidneys) and acute acquired methemoglobinemia ("blue baby syndrome") are not reportable diseases in Idaho, only the cancer incidence is discussed in this section.

3.5.1 Data Review

The health outcome data evaluation from the EMF site is based on an analysis of available cancer data from the CDRI. CDRI is an Idaho Hospital Association program that contracts with Idaho Department of Health and Welfare to provide a statewide cancer surveillance system. The Registry is a population-based cancer registry that collects incidence and survival data on all cancer patients who reside in the State of Idaho and/or are treated for cancer in the State of Idaho. Through collaborative efforts with Idaho's neighboring states, CDRI is able to obtain cancer cases of Idaho residents diagnosed and/or treated for cancer in adjacent states. CDRI has been in operation since 1969 and the registry became population based in 1971. Each Idaho hospital, outpatient surgery center, and pathology laboratory is responsible for reporting cancer diagnoses and treatments within six months after services are provided. CDRI has a 99.6% case completeness rate and a 98.6% accuracy rate.

The period selected for each evaluation of the cancer incidence data was 1990 – 2001. This is the most recent data available for analysis. Cancer incidence was reviewed for this public health assessment instead of cancer mortality because cancer death rates are affected by how advanced the cancer was at the time of diagnosis, access to health care and other factors not related to exposure.

3.5.2 Data Analysis

The cancer incidence analysis was conducted for the EMF study area (Appendix I, Figure 4). Since Census Block Group (CBG) population data do not correspond exactly to the boundary of the EMF site impact area, CBGs were aggregated to form an analysis area (Appendix J, Figure J-1), and the cancer incidence analysis was conducted for this aggregate area. Cancer incidence for the analysis area was calculated by comparing the observed number of cases to the expected number of cases (also known as standardized incidence ratio) (Appendix J, Table J-1 and J-2). The expected number was calculated by multiplying rates for the remainder of Idaho by the population of the study area. Rates for the remainder of Idaho were calculated by dividing observed cases by the person-years for the remainder of Idaho. Person-years describe the length of time a group of people have been exposed, observed, or at risk.

To help interpret the difference between cancer incidence in the study area population and the remainder of Idaho, the "statistical significance" of the difference is calculated. "Statistical significance" for this public health assessment means that there is less than a 5% chance that the observed difference is due to random chance alone ($p<0.05$). In other words, if the difference was found to be statistically significant, then the difference between the expected and observed cases is probably due to some set of factors that influences the rate of that disease. It could be environmental factors, lifestyle factors, and/or family histories. In the public health assessment, only statistically significant differences are discussed.

Cancer is not a single disease. It is a group of more than 200 different diseases. Because cancer is, unfortunately, a common disease (one of every three of us will develop cancer in our lifetime), every community will experience a certain number of cancers. Different types of cancer have different causes and are likely to be linked to different risk factors. As discussed previously, in the past, the high levels of arsenic in the Old Pilot Café well and the Frontier well may cause high risk of developing skin, liver, bladder, and kidney cancers. Also, the air contamination in the past may cause higher risk of developing lung cancer. Therefore, BCEH selected the specific cancer types (skin, liver, bladder, kidney and lung) which, according to scientific studies, are biologically plausible as a result of exposure to site-related contaminants.

3.5.3 Results of Cancer Incidence Analysis

<u>The EMF Cancer Analysis Area (Appendix J, Figure J-1)</u>

Geocoded cancer cases diagnosed from 1990-2001 were queried from within the EMF cancer analysis area (Appendix J, Figure J-1), and the remainder of geocoded cases in the State of Idaho comprised the comparison group. An estimate of person-years (the denominator for the cancer incidence rates) was obtained by taking the April 1, 1990 census population count for the EMF

cancer analysis area and for Bannock County and calculating the proportion of the Bannock County population that is in the EMF cancer analysis area, then applying this proportion to the estimated person-years for 1990-2001 by 5-year age group and sex. Person-years for the study area were estimated by summing population estimates for the study area over the time period of the study. The person-years for the remainder of Idaho were calculated by subtracting the person-years for the EMF cancer analysis area from the State of Idaho (Johnson 2004).

There is an inherent problem in comparing small area cancer incidence rates in Idaho because not all cancer cases can be geocoded at the same level of accuracy. Thus, cancer cases that may have resided in the EMF cancer analysis area but whose address did not allow for accurate geocoding may have been assigned a geocode for the ZIP Code or County centroid and may inadvertently be misclassified. At the same time, cancer rates for the remainder of the state include cases geocoded to any level of accuracy (address, zip code or county level). This is because delineation of the state cases require less precision than that of smaller areas within the state. Therefore, when geocoded cases within the EMF cancer analysis area are compared to geocoded cases in the remainder of the state, some cases that truly reside within the analysis area may not be counted resulting in an understatement of cancer incidence rates for the analysis area.

Overall, about 90% of cases in Bannock County were able to be geocoded to the Census Block Group level or better (which would be included in a Census Block Group analysis). Therefore an additional analysis was run using only cancer cases geocoded to the Census Block Group level or better for both the EMF cancer analysis area and the remainder of the State of Idaho. However, in most of the remainder of Idaho, cases are not geocoded as well as in Bannock County, therefore, in contrast to the first analysis, the cancer incidence rates may be understated for the remainder of Idaho and comparisons may show falsely elevated rates in the EMF cancer analysis area (Johnson 2004).

The two tables (Appendix J, Table J-1 and J-2) show very different results. Table J-1: *Comparison of cancer incidence rates between the Eastern Michaud Flats cancer analysis area and the remainder of the state of Idaho using all geocoded cases* (Appendix J) shows the EMF cancer analysis area has statistically significantly lower rates of cancer than the remainder of Idaho for several sites and overall. Table J-2: *Comparison of cancer incidence rates between the Eastern Michaud Flats cancer analysis area and the remainder of the state of Idaho using cases geocoded to the Census Block Group quality or better* (Appendix J) shows mixed results with several elevated rates of cancer incidence for the EMF cancer analysis area. For the selected cancers that might be associated with the contaminants in EMF area (skin, liver, kidney, lung, and bladder cancers), there were only significantly more female bladder cancers compared to the remainder of the State (Appendix J, Table J-2). Since this analysis likely understates rates for the comparison area (Johnson 2004), it can be conservatively stated that no elevation in skin, liver, kidney, and lung cancers exists. Based on this analysis, it is not possible to determine whether there are really significantly more female bladder cancers. Even if there are significantly more female bladder cancers, since tobacco consumption has been associated with a six-fold higher incidence of bladder tumor (Silverman et al. 1999), it is not possible at this time for BCEH to determine if the contamination in the EMF area is associated with the increased female bladder cancer incidence in the area of analysis.

Fort Hall Indian Reservation Area

Because specific information regarding tribal membership is not part of the information in the CDRI, CDRI did not calculate the cancer rates specific to the Fort Hall Indian Reservation for this public health assessment. Instead CDRI calculated cancer rates for Native Americans in general (American Indian/Alaska Native) in the three counties that contain the Fort Hall Indian Reservation (Bingham, Bannock and Power Counties). The cancer rates for American Indian/Alaska Native (Appendix J, Table J-3) were compared to those found in the report *Cancer in Idaho by Race and Ethnicity* (Johnson and Carson 2003).

In Bingham County, where the majority of the Fort Hall Indian Reservation is located, the cancer rates of the selected cancers (skin, liver, kidney, lung, and bladder cancers) for American Indians/Alaska Natives are all lower than those found in the report *Cancer in Idaho by Race and Ethnicity* (Johnson and Carson 2003). In the three counties combined, among the selected cancers, only one more liver and two more skin cancers were observed compared to those expected based on rates found in *Cancer in Idaho by Race and Ethnicity*. Therefore, according to this analysis, it is unlikely that the contamination in the EMF area resulted in any increased cancer incidence to the Native Americans in the three counties that contain the Fort Hall Indian Reservation.

3.6 Community Health Concerns

As a result of past health consultations and while conducting this public health assessment, BCEH was made aware of some community health concerns by residents of Pocatello, Chubbuck and Fort Hall. EPA also provided information regarding community members' health concerns.

3.6.1 Health Effects of Air Pollution

When ATSDR conducted the health consultation for air contamination in the EMF study area (ATSDR 2001), community members in the area expressed their concerns about a potential increase in the incidence of asthma, upper respiratory illness, and heart disease. During the course of this public health assessment, community members again expressed their concerns regarding a perceived elevated incidence of respiratory disease in the EMF area. ATSDR is currently conducting a health study to assess health impacts of particulate matter exposures on residents of the cities of Chubbuck and Pocatello.

3.6.2 Fugitive Emissions from the Simplot Gypsum Stack

During the course of this public health assessment, concerns were expressed regarding potential exposures to the fugitive dust from Simplot's gypsum stack. Residents have noted that on windy days a visible cloud of dust can be seen blowing off of roads and the sides of the gypsum stack.

As discussed in the air exposure pathway (Section 3.3.4.1), PM10 and PM2.5 are no longer a public health hazard in Chubbuck and Pocatello as well as on the Fort Hall Indian Reservation at present. Monitoring data from the Primary and Sho-Ban stations, which are nearest to the site, show that 24-hour health-based comparison values for PM10 were exceeded only once (at both

stations) since FMC shut down operations. PM2.5 concentrations (24-hour average) have not exceeded EPA's health-based comparison values since 2000. There is, however, some uncertainty about the impact of high-level, short-term (hourly) exposures to PM on human health. Due to a lack of studies that examine these health effects, it is difficult for BCEH to determine the health risks associated with high-level, hourly PM exposures that may occur on days when 24-hour average standards are not exceeded.

Simplot is currently in the process of enacting cleanup and monitoring requirements of the Consent Decree that address identified sources of threats to public health, including the control of fugitive emissions from permanent roads on the gypsum stack.

3.6.3 Odor Complaints and Associated Health Effects

Community members have contacted IDEQ to express concern about odors coming from the EMF site and health effects associated with these odors. IDEQ has logged odor complaints from community members from 1999 to 2003. According to IDEQ's complaint log, community members began noting health effects associated with these odors in 2001. These health effects include burning sensations in the eyes, nose, and throat and on the skin, nausea, headache, difficulty breathing, nose bleeds, asthma and respiratory effects associated with these odors. The odors are described as having acidic, burnt almond, methane and sulfur smells.

According to the EPA Toxic Release Inventory (TRI), the Simplot facility releases ammonia, nitrogen oxides, hydrogen fluoride, and acid aerosols to the environment through both fugitive and direct emissions. The symptoms reported to IDEQ by community members are consistent with those that may result from exposures to Simplot's reported TRI emissions. Short-term exposures to ammonia at concentrations of 50 ppm have resulted in irritation to the eyes, nose, and throat in humans. Low levels of nitrogen oxides in the air can irritate the eyes, nose, throat, and lungs, possibly causing the exposed person to cough and experience shortness of breath, tiredness, and nausea. Long term exposure to hydrogen fluoride can result in irritation and congestion of the nose, throat, and lungs at low levels.

ATSDR and BCEH obtained and reviewed ambient air monitoring data for several ionic species. As discussed in the air exposure pathway (Section 3.3.4.1) as well as in the past health consultation (Appendix I), the chemical concentrations in air (including ammonium ion, nitrate ion, fluoride ion, chloride ion, sulfate ion) measured at Garrett and Gould and other IDEQ monitoring stations (Appendix I) were unlikely to cause adverse non-carcinogenic health effects or result in an appreciable increased risk of cancer in the exposed population. In addition, the measured ambient air concentrations of sulfur dioxide at the Pocatello Sewage Treatment Plant from 1999 to 2003 were also below EPA's health-based comparison value (0.03 parts per million, ppm).

In order to address community complaints, Simplot has been working with GE Betz Company on odor reductions. IDEQ is currently working with Simplot to establish an odor management plan to control odor intensities (Floyd 2004). EPA has also set Maximum Achievable Control Technology standards for Simplot's stack emissions of acids. Simplot is currently in the first year of monitoring to comply with these standards (Edwards 2004).

Since studies have linked exposure of acid aerosols to an increased incidence of adverse health effects among sensitive populations and some people may be more sensitive to odors than others, BCEH encourages community members to continue to report odors and associated symptoms to IDEQ. BCEH also recommends that IDEQ continue to work with Simplot to address site odor issues and IDEQ continue to track odor complaints (in particular, residential or industrial areas where complaints originate) and health effects associated with these odors and follow up with exposure point monitoring as appropriate.

3.6.4 Occupational Exposures to Former Workers

Former workers have expressed their concerns regarding past occupational exposures to contaminants at the two facilities and consequent exposures to their families. ATSDR's official mandate under the 1980 Superfund law, and as amended in 1986, focuses primarily on health issues related to the uncontrolled release of hazardous substances into the environment as it relates to community exposures. Except for very limited authority to examine health issues of workers' exposure to Superfund waste and those who perform remediation tasks, ATSDR's mandate does not include the health of workers--an issue that is mainly the responsibility of the Occupational Safety and Health Administration (OSHA) and the National Institute for Occupational Safety and Health (NIOSH). These agencies can evaluate in much greater detail worker health issues at the EMF site.

Through its Health Hazard Evaluation (HHE) Program, NIOSH evaluates whether health hazards occur as a result of workers being exposed to hazardous substances while on the job. NIOSH conducts HHEs only after receiving a written request to do so. These requests must come from three or more current employees, or the employer. Employees who request that an HHE be performed will remain anonymous, if requested. Further information about the NIOSH HHE program can be found on the Web (at http://www.cdc.gov/niosh/hhe/) or by contacting NIOSH at 1-800-356-4674.

In addition, former workers who are concerned about work-related illness can contact the Association of Occupational and Environmental Clinics (AOEC). The AOEC is a network of more than 60 clinics and more than 250 individuals trained in occupation and environmental medicine. The AOEC received funding through multi-year cooperative agreements with ATSDR and NIOSH.

The nearest AOEC clinic to the Pocatello area is located in Salt Lake City. For more information on work-related illness and occupational medicine, contact:

Kurt Hegmann, MD, MPH
Rocky Mountain Center for Occupational and Environmental Health
75 South 2000 East
University of Utah
Salt Lake City, Utah 84112-0512
PHONE (801) 581-5056
FAX (801) 581-3756

4. CONCLUSIONS

Based upon the data and information reviewed, BCEH has drawn the following conclusions:

1. **The current** completed exposure pathways include surface soil, surface water/sediment, air, and residential exposure to radiation from slag. A potential exposure pathway exists for site-related contaminants for individuals who consume fish from the Portneuf River. The groundwater exposure pathway is currently an eliminated exposure pathway and has been since the early 1990's.

2. **In the past**, the EMF site was classified as a *Public Health Hazard* according to ATSDR's Interim Public Health Hazard Categories (Appendix C), based on past exposure: 1) to groundwater from the Old Pilot Café well, the Frontier well, and Batiste Spring; 2) of FMC workers to cadmium in surface soils; 3) of slag and gypsum workers at both facilities to alpha, beta, and gamma radiation; and 4) of the general public to air contamination. It was determined that:

    - Long term (greater than a year) employees at the Old Pilot Café (from the early 1950's through 1976) and the Frontier Building (from 1943 to the late 1980's) may be at higher risk of developing skin, liver, bladder, and kidney cancers if they drank a significant amount of water at work due to elevated arsenic concentrations in the drinking water. These same people may also have lower production of red and white blood cells, abnormal heart rhythm, and blood-vessel damage (e.g., Raynaud's disease and cyanosis of fingers and toes).

    - If an infant (less than four months of age) was fed formula made with water from the Old Pilot Café well (prior to 1976) or the Batiste Spring (before early 1990's) for several days, the infant would have had an increased risk of developing acute acquired methemoglobinemia ("blue baby syndrome") due to elevated nitrate/nitrite concentrations in the drinking water. Symptoms of methemoglobinemia would be apparent within a few days of exposure.

    - Workers at the FMC facility (before FMC ceased production of elemental phosphorous in December 2001) may have been exposed to cadmium contaminated surface soil. These exposures may have increased the potential for the workers who smoke to develop proteinuria (excess proteins found in the urine because of damage to the kidneys).

    - Depending upon work practices (e.g., amount of dust generated and personal protective devices used) and personal hygiene habits (e.g., how often hands are washed), slag or gypsum pile workers at both facilities may have been exposed to gross alpha, beta, and gamma radiation. These exposures may have increased the cancer risk for slag or gypsum pile workers. However, these past exposures could have been significantly reduced by good occupational practices (e.g., shielding provided by vehicles and dust control), thereby significantly reducing the workers' risk of developing cancer.

- Before 2000, levels of particulate matter in air throughout Chubbuck and Pocatello, as well as part of the Fort Hall Indian Reservation between FMC and Interstate 86, periodically exceeded EPA's health-based comparison values for PM10 and PM2.5 reaching unhealthy air pollution levels as a result of emissions from FMC, Simplot, and other sources.

3. **At present**, BCEH classifies the EMF site as a *No Apparent Public Health Hazard* because 1) no one is drinking site-contaminated groundwater; 2) the FMC facility no longer employs production workers at the site; 3) the annual average concentrations of PM10 and PM2.5 steadily decreased between 2000 and 2003, and PM10 levels exceeded EPA's health-based comparison value only once (April 23, 2002) since 2001.

4. **In the future**, there are some uncertainties about the public health hazard associated with air contamination. Although PM10 and PM2.5 in the EMF area have seldom exceeded EPA's health-based comparison values since 2001, BCEH is not certain that unhealthy PM levels (such as those that occurred during a severe winter inversion in December 1999) will not happen again in severe inversion-producing conditions. Therefore, BCEH recommends that measures to control air pollution remain in place and classifies the EMF site as an *Indeterminate Public Health Hazard* in the future.

5. Gypsum pile workers at the Simplot facility may presently be exposed to elevated levels of alpha, beta, and gamma radiation. These exposures may increase the risk of a worker developing cancer. However these exposures could be significantly reduced by following good occupational practices (e.g., shielding provided by vehicles and dust control), thereby significantly reducing the workers' risk of developing cancer.

6. Due to the limited available data, BCEH can not accurately evaluate the health effects of exposure to the radiation from slag used in the communities at this time.

7. Due to lack of site-related contaminants data in the fish tissue, BCEH can not evaluate the possible health effects of consumption of fish from the Portneuf River at this time.

8. The health outcome data analysis for the cities of Pocatello and Chubbuck and for the Fort Hall Reservation does not indicate any increased cancer incidence for cancers known to be associated with site-related contaminants except for female bladder cancer. However, this association may be due to a potential underestimation of state-wide cancer rates for cancer cases geocoded at fine levels of geographic detail.

9. The health concerns expressed by community members in the EMF area (i.e. health effects of air pollution, fugitive emissions from the gypsum stack, odor complaints, etc.) were reviewed and are reasonably consistent with the contamination on the EMF site. ATSDR, Simplot, and IDEQ are addressing these health concerns (i.e. ATSDR's health study, Simplot's fugitive emission control from permanent roads on the gypsum stack, and odor reduction and odor management plans).

10. The conclusions in this report only apply to the current site conditions. If land uses change, these conclusions may no longer be applicable.

5. RECOMMENDATIONS

Based upon the data and information reviewed, BCEH has made the following recommendations:

1. Appropriate remedial actions, worker protection activities, and worker safety procedures should be instituted or continued to prevent workers from exposures to site-related contaminants in surface soil, surface water and sediment, such as a worker protection plan to protect gypsum workers of Simplot from radiation exposures.

2. Appropriate remedial actions and monitoring should be instituted or continued to prevent surface soil contaminants from migrating into the local groundwater and surface water, as well as to prevent future migration of site-related groundwater contaminants into any drinking water sources.

3. The land deed restrictions instituted and planned for the property presently owned by FMC and Simplot should remain in effect so that the land will not be developed into residential or agricultural areas, and the shallow groundwater will not be used for drinking water.

4. FMC and Simplot should continue to monitor the groundwater to assure that site-related contaminants do not impact drinking water sources.

5. IDEQ and the Shoshone-Bannock Tribes should continue to monitor air contamination to further characterize air quality trends (including PM10 and PM 2.5). Analysis of PM10 filters for metals and inorganics (Chemical Mass Balance) should be done on a regular basis to address chronic exposure to metals.

6. IDEQ should continue to issue warnings on days when levels of air pollution are expected to reach potentially unhealthy levels and to communicate these warnings to the local public and media.

7. EPA, IDEQ, the Shoshone-Bannock Tribes, and the cities of Chubbuck and Pocatello should continue to develop, implement, and enforce air pollution control initiatives to minimize the amount of particulate matter released to the air in the EMF area.

8. Concerned homeowners and other building owners in Pocatello area and on the Fort Hall Reservation area should contact the Southeast Idaho District Health Department to participate in the voluntary Slag Exposure Study, which is still ongoing.

9. The suspension on the sale of slag for all construction uses should remain in place.

10. BCEH should coordinate with Idaho Department of Fish and Game (IDFG) to test fish from the Portneuf River for PCBs and heavy metals and then evaluate possible health effects associated with eating fish from the Portneuf River.

11. IDEQ should continue to work with Simplot to address site odor issues. IDEQ should also continue to track odor complaints (in particular, residential or industrial areas where complaints originate) and health effects associated with these odors and follow up with exposure point monitoring as appropriate.

12. In response to community health concerns, cancer surveillance in the EMF area should continue including an analysis of cancer incidence for Shoshone-Bannock Tribal members.

6. PUBLIC HEALTH ACTION PLAN

The purpose of the public health action plan is to ensure this public health assessment not only identifies any current and potential exposure pathways and related health hazards, but also to provide a plan of action to mitigate and prevent adverse human health effects resulting from exposures to hazardous substances in the environment. The following lists the ongoing or planned actions by BCEH, ATSDR, Shoshone-Bannock Tribes, EPA, and other agencies, as well as FMC and Simplot.

1. BCEH has assembled the Eastern Michaud Flats Work Group, which consists of state, federal, and tribal environmental and health agency staff and community members, to assist and advise in the implementation of community health education activities. BCEH will continue to conduct health education/outreach activities as needed.

2. FMC and EPA are working on a Supplemental Remedial Investigation and Feasibility Study for the FMC operable unit based on potential future industrial or commercial redevelopment of the FMC facility.

3. IDEQ has completed the *Portneuf Valley PM_{10} Nonattainment Area (PVNAA) State Implementation Plan (SIP), Maintenance Plan, and Redesignation Request*. This plan outlines that Pocatello, Chubbuck, Inkom and a portion of the Fort Hall Reservation will ensure continued attainment of the Clean Air Act National Ambient Air Quality Standards (NAAQS) for annual and 24-hour PM_{10}.

4. EPA, Southeastern District Health Department, and FMC are conducting the ongoing Idaho Slag Exposure study, which is a voluntary program to help residents find out if phosphorus slag in their homes and business properties is causing unacceptably high exposure to radiation.

5. BCEH will further evaluate slag exposure data generated by the Slag Exposure Study when and if it becomes available.

6. BCEH will work with Idaho Department of Fish and Game (IDFG) and the IDHW Bureau of Laboratories to analyze edible fish harvested from the Portneuf River for site-related

contaminants. BCEH will evaluate possible health effects associated with fish consumed from the Portneuf River.

7. BCEH and CDRI will periodically monitor cancer incidence.

8. ATSDR is conducting a health study to determine if an association exists between past particulate matter air pollution exposures and hospital admissions and other visits (including emergency room, urgent care, and family practice) for heart and lung conditions. Because of the availability of quality exposure data, this study is limited to the residents of Chubbuck and Pocatello.

9. The Shoshone-Bannock Tribes, FMC, and independent experts will conduct a Tribal Health Study for the Shoshone-Bannock Tribes using existing data provided by the Fort Hall Clinic and the Cancer Data Registry of Idaho. This study is funded by FMC under the Resource Conservation and Recovery Act (RCRA) Consent Decree as part of a Special Environmental Project (SEP #14).

10. Simplot is in the process of enacting cleanup and monitoring requirements of its Consent Decree that addresses identified sources of threats to public health.

11. BCEH will review new environmental sampling data and studies relevant to the public health of communities near the EMF site as they become available.

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9. CERTIFICATION

The Idaho Bureau of Community and Environmental Health prepared this Public Health Assessment under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the Public Health Assessment was initiated.

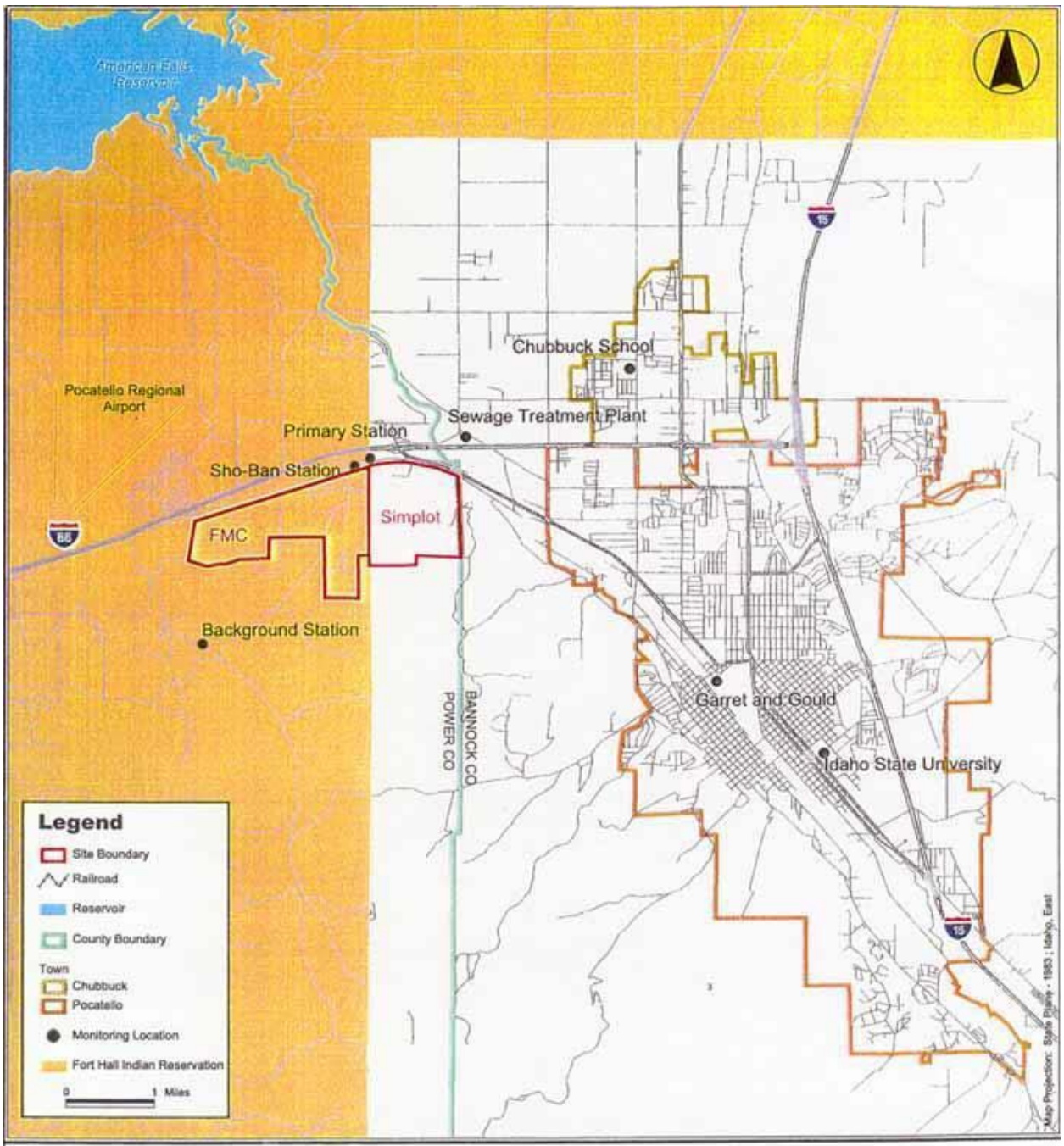
Technical Project Officer, SSAB, DHAC

The Superfund Site Assessment Branch (SSAB), Division of Health Assessment and Consultation (DHAC), ATSDR has reviewed this health consultation and concurs with its findings.

Chief, SSAB, DHAC, ATSDR

Appendix A

The Maps of Eastern Michaud Flats Contamination Site



Eastern Michaud Flats

Pocatello, Idaho

CERCLIS No. IDD984666610

Figure A-1 Air Monitoring Locations

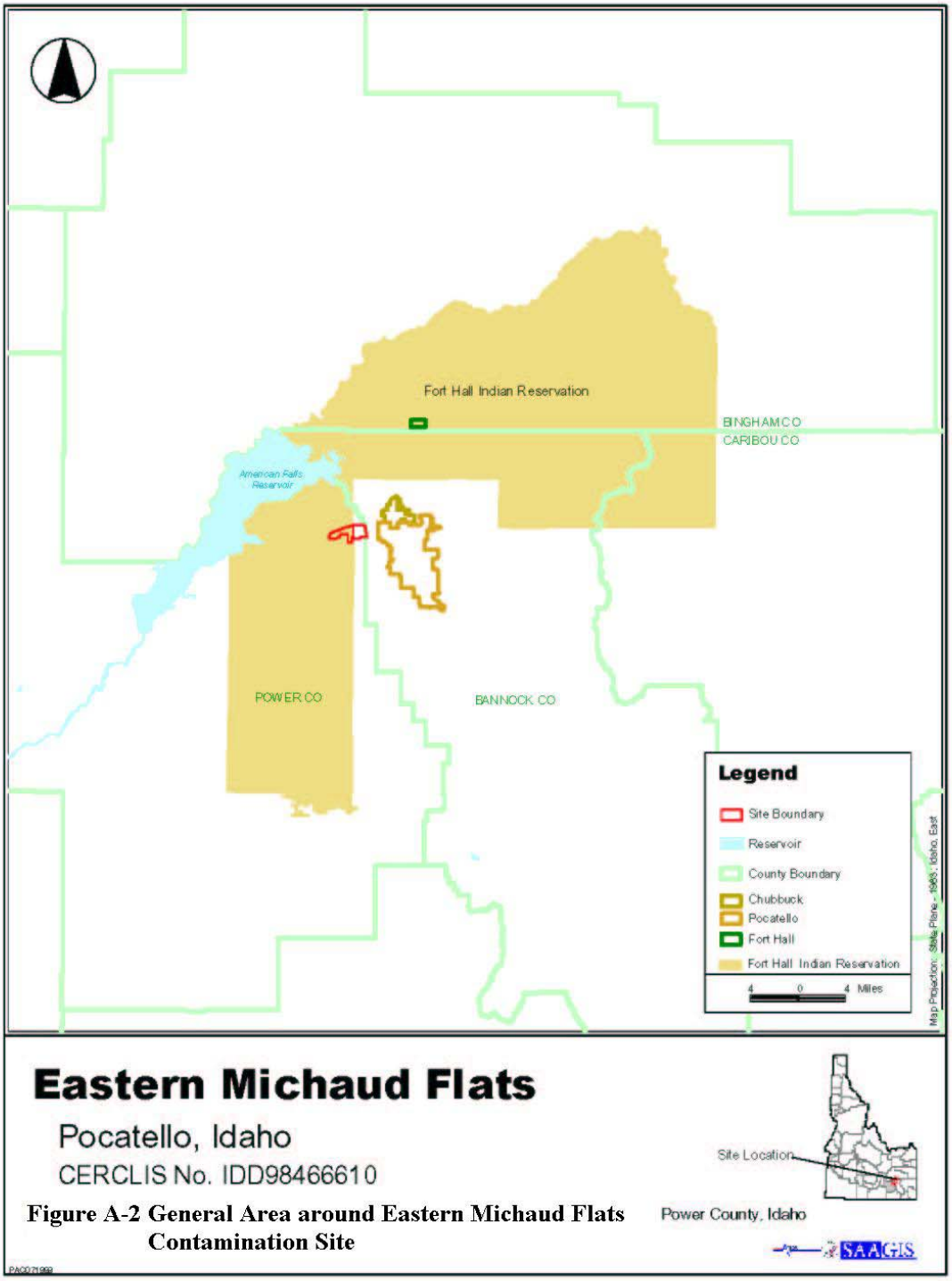


Figure A-2 General Area around Eastern Michaud Flats Contamination Site

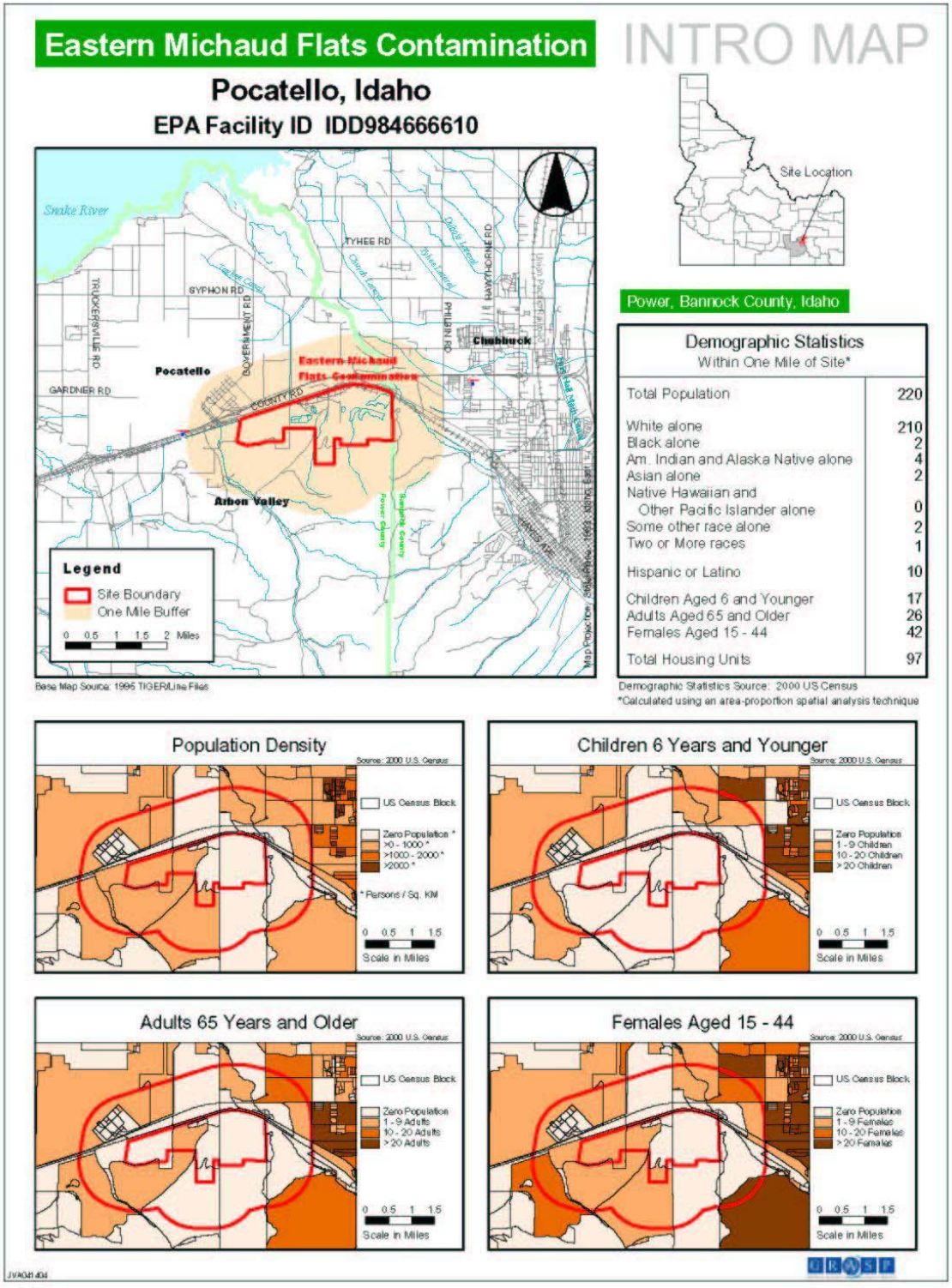


Figure A-3 Demographic Map

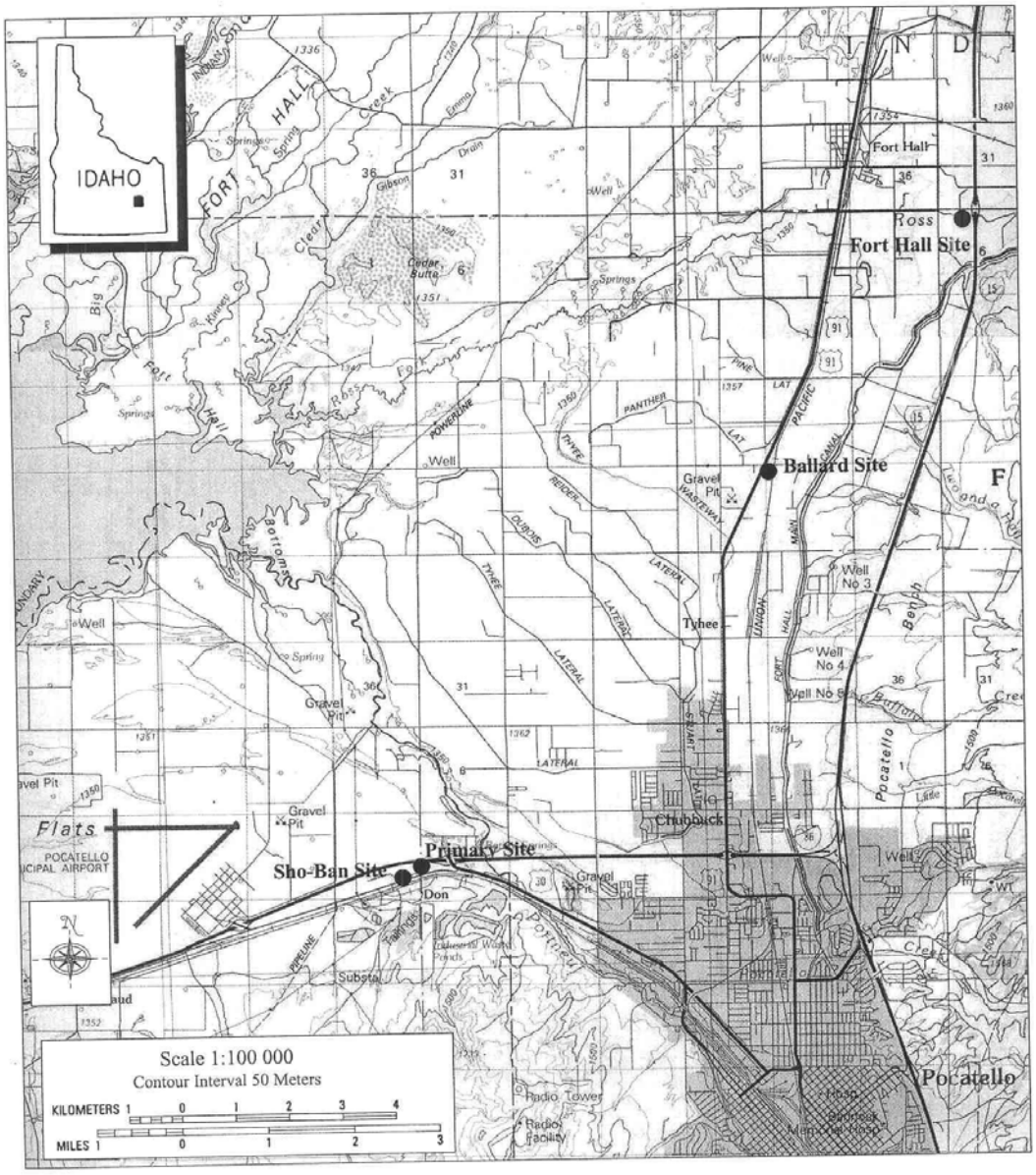


Figure A-4 Sho-Ban/EPA Particulate Monitoring Program Sites, Pocatello, Idaho

Appendix B

Data Tables

Table B-1 Maximum Concentration (milligrams per liter) of Site-Related Groundwater Contaminants Found in Monitoring Wells 524 and 525

Monitoring Well	Calendar Year	Arsenic (Total) (mg/L)	Nitrate (mg/L)	Selenium (mg/L)	Sulfate (mg/L)
Well 524	1994	0.0034	2.66	0.0035	51.0
	1995	0.0038	1.57	0.0021	96.4
	1996	0.0054	3.41	0.0050	90.0
	1997	0.0050	2.90	0.0050	53.0
	1998	0.0050	1.60	0.0050	55.8
	1999	0.0039	1.70	0.0050	47.4
	2000	0.0050	1.50	0.0050	43.9
	2001	0.0050	2.10	0.0050	42.7
	2002	0.0050	2.00	0.0050	41.6
	2003	0.0050	1.90	0.0050	43.9
Well 525	1994	0.0033	2.29	0.0035	55.0
	1995	0.0038	2.51	0.0021	55.8
	1996	0.0076	3.65	0.0050	94.0
	1997	0.0090	4.30	0.0050	100.0
	1998	0.0050	2.00	0.0050	84.0
	1999	0.0050	2.60	0.0050	61.9
	2000	0.0050	1.60	0.0050	46.6
	2001	0.0042	2.20	0.0050	43.8
	2002	0.0050	2.10	0.0050	42.7
	2003	0.0050	2.00	0.0050	45.8
Comparison Values and Source		**0.01 EMEG**	**10 MCL**	**0.2 EMEG**	**250 SMCL**

EMEG: Environmental Media Evaluation Guide
MCL: Maximum Contaminant Level
SMCL: Secondary Maximum Contaminant Level

Table B-2 Summary of Ambient Air Monitoring Data (PM10) Collected by IDEQ Air Monitoring Network (2000-2003)

Station	Maximum 24-Hour Average Concentration (μg/m^3)			
	2000	2001	2002	2003
Sewage Treatment Plant	141 (April 6)	85 (Sept. 25)	74 (May 14)	N/A[a]
Garrett and Gould	112 (Feb. 6)	81 (Feb. 28)	66 (Feb. 4)	88 (July 8)

Station	Annual Weighted Average Concentration (μg/m^3)			
	2000	2001	2002	2003
Sewage Treatment Plant	31	27	N/A[a]	N/A[a]
Garrett and Gould	25	26	25	22

Note: Source of data: IDEQ 2004a
Chubbuck School PM10 monitor was shut down on June 29, 1999
Idaho State University PM10 monitor was shut down on May 30, 1999
EPA's National Ambient Air Quality Standards (NAAQS) for 24-hour and annual average PM10 concentrations are 150 μg/m^3 and 50 μg/m^3 respectively.
[a] N/A: not available, since the Pocatello Sewage Treatment Plant PM10 monitor was shut down on June 28, 2002

Table B-3 Summary of Ambient Air Monitoring Data (PM2.5) Collected by IDEQ Air Monitoring Network (2000-2003)

Station	Maximum 24-Hour Average Concentration (μg/m^3)			
	2000	2001	2002	2003
Chubbuck School	61 (Dec. 8)	41 (Jan. 7)	42.4 (Feb. 4)	19.7 (Jan. 9)
Garrett and Gould	**72.7** (Feb. 6)	51.2 (Jan. 6)	43.8 (Feb. 4)	21.9 (Jan. 9)

Station	Annual Weighted Average Concentration (μg/m^3)			
	2000	2001	2002	2003
Chubbuck School	10.4	8.7	8.5	N/A[a]
Garrett and Gould	10.5	9.9	8.8	5.9

Note: Source of data: IDEQ 2004a
EPA's National Ambient Air Quality Standards (NAAQS) for 24-hour and Annual average PM2.5 concentrations are 65 μg/m^3 and 15 μg/m^3 respectively. Bold concentrations exceed NAAQS.
[a] N/A: not available, since the Chubbuck School PM2.5 monitor was shut down on July 8, 2003

Table B-4 Annual Arithmetic Average Concentrations of Sulfur Dioxide (parts per million) From the Monitor Located at the Pocatello Sewage Treatment Plant

Calendar Year	Annual Average Concentration of Sulfur Dioxide (ppm)
1999	0.0073
2000	0.0084
2001	0.0073
2002	0.0050
2003	0.0047

Note: Source of data: IDEQ 2004a
EPA's National Ambient Air Quality Standards (NAAQS) for Sulfur Dioxide concentrations is 0.03 ppm.

Table B-5 Summary of Ambient Air Monitoring Data (PM10) Collected by the Shoshone-Bannock Tribes (2000-2003)

Station	Maximum 24-Hour Average Concentration (μg/m^3)			
	2000[a]	2001	2002	2003
Primary	**187.5** (April 6)	145.1 (Sept. 25)	**214.1** (April 23)	103.3 (July 8)
Sho-Ban	**250.7** (June 8)	108.6 (Sept 25)	**202.9** (April 23)	41.5 (Jan. 18)
Ballard		34.2 (Dec.27)	86.1 (Oct. 17)	14.8 (Feb. 2)
Fort Hall	135.5 (April 6)	**168.9** (Aug. 11)	135.7 (May 20)	134.8 (Sept. 30)

Station	Annual Weighted Average Concentration (μg/m^3)			
	2000	2001	2002	2003
Primary	**57.8**	38.3	27.1	24.0
Sho-Ban	**49.5**	31.9	28.9	N/A[b]
Ballard		N/A[c]	25.5	N/A[c]
Fort Hall	N/A[d]	30.3	36.4	36.8

Note: Source of data: Sho-Ban 2004
EPA's National Ambient Air Quality Standards (NAAQS) for 24-hour and Annual average PM10 concentrations are 150 μg/m^3 and 50 μg/m^3 respectively. Bold concentrations exceed NAAQS.

[a] In 2000, the 24-hour average concentrations of PM10 exceeded EPA's NAAQS (150 μg/m^3) three times at both Primary and Sho-Ban Station.

[b] N/A: not available, since the Sho-Ban PM10 monitor was shut down on March 31, 2003.

[c] N/A: not available, since Ballard PM10 monitor started on November 15, 2001, and was shut down on March 28, 2003.

[d] N/A: not available, since the Fort Hall PM10 monitor started on March 25, 2000.

Table B-6 Summary of Ambient Air Monitoring Data (PM2.5) Collected by the Shoshone-Bannock Tribes (2000-2003)

Calendar Year	PM2.5 Monitoring Data at Primary Station	
	Annual Average Concentration (μg/m^3)	Maximum 24-Hour Average Concentration (μg/m^3)
2000	N/A[a]	57.2 (April 12)
2001	14.5	39.1 (March 8)
2002	10.5	38.4 (March 3)
2003	7.6	22.7 (Jan. 21)

Note: Source of data: Sho-Ban 2004
EPA's National Ambient Air Quality Standards (NAAQS) for 24-hour and Annual average PM2.5 concentrations are 65 μg/m^3 and 15 μg/m^3 respectively.

[a] N/A: not available, since the Primary PM2.5 monitor started on March 31, 2000.

Table B-7 Radionuclides Detected in Air Samples Collected in the Vicinity of EMF (October-December 1993)

Radioisotope	Site-Related Background Concentration* (pCi/m^3)	Range of detected contaminants related to Eastern Michaud Flats (pCi/m^3)
Uranium 238	8.7×10^{-6}	1×10^{-5} to 3.8×10^{-4}
Uranium 235	4.1×10^{-7}	5×10^{-7} to 1.9×10^{-5}
Uranium 234	9.3×10^{-6}	1.1×10^{-5} to 4.0×10^{-4}
Thorium 230	3.5×10^{-5} (DL)§	ND[a] to 2.85×10^{-4}
Radium 226	5.31×10^{-4} (DL)	ND[a] to 5.9×10^{-4}
Polonium 210	4.4×10^{-3}	6.7×10^{-3} to 6.9×10^{-2}
Lead 210	1.7×10^{-2}	2.1 to 2.5×10^{-2}
Thorium 232	4.1×10^{-5}	ND[a]
Radium 228	1.97×10^{-3}	ND[a]

***** Data from *Remedial Investigation and Feasibility Study Report for the Eastern Michaud Flats Site. Part III. Air Quality characterization. Air Monitoring Report.* Volume II, sections 1 to 6. August 1996. Bechtel.

§ Detection Limit – the instrument detection limit is the lowest value the monitoring equipment could detect.

[a]ND – not detectable, below the detection limit

Table B-8 Estimated Radiological Doses to Organs of Concern*

Organ	10 year old Child†	Adult
Bone Surface	22 millirem	48 millirem
Bone Red Marrow	7	5
Lungs	109	75

*The calculated dose, expressed in millirem and rounded to the next whole number, is the total from all radionuclides listed in Table B-7. The dose was derived by converting the values given in Table B-7 to millirem per year. Breathing patterns used are those derived from the EPA *Exposure Factors Handbook* (EPA 1999b). The dose conversion factors were derived from the International Commission on Radiological Protection (ICRP 1996).
†Age at Intake

Appendix C

ATSDR Interim Public Health Hazard Categories

Table C-1 Interim Public Health Hazard Categories

CATEGORY/DEFINITION	DATA SUFFICIENCY	CRITERIA
Urgent Public Health Hazard This category is used for sites where short-term exposures (<1yr) to hazardous substances or conditions that could result in adverse health effects that require rapid intervention.	This determination represents a professional judgment based on critical data, which ATSDR has judged sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.	Evaluation of available relevant information* indicated that site-specific conditions or likely exposures have had, are having, or are likely to have in the future, an adverse impact on human health that requires immediate action or intervention. Such site-specific conditions or exposures may include the pre of serious physical or safety hazards.
Public Health Hazard This category is used for sites that pose a public health hazard due to the existence of long-term exposure (>1yr) to hazardous substances or conditions that could result in adverse health effects.	This determination represents a professional judgment based on critical data, which ATSDR has judged sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.	Evaluation of available relevant information* suggests that, under site-specific conditions of exposure, long-term exposures to site-specific contaminants (including radionuclides) have had, are having, or are likely to have in the future, an adverse impact on human health that requires one of more public health interventions. Such site-specific exposures may include the presence of serious physical or safety hazards.
Indeterminate Public Health Hazard This category is used for sites in which "critical" data are insufficient with regard to extent of exposure and/or toxicological properties at estimated exposure levels.	This determination represents a professional judgment that critical data are missing and ATSDR has judged the data are insufficient to support a decision. This does not necessarily imply all data are incomplete; but that some additional data are required to support a decision.	The health assessor much determine, using professional judgment, the "criticality" of such data and the likelihood that the data can be obtained and will be obtained in a timely manner. Where some data are available, even limited data, the health assessor is encouraged to the extent possible to select other hazard categories and to support their decision with clear narrative that explains the limits of the data and the rationale for the decision.
No Apparent Public Health Hazard This category is used for sites where human exposure to contaminated media may be occurring, may have occurred in the past, and/or may occur in the future, but the exposure is not expected to cause any adverse health effects.	This determination represents a professional judgment based on critical data, which ATSDR considers sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.	Evaluation of available relevant information* indicates that, under site-specific conditions of exposure, exposures, exposure to site-specific contaminants in the past, present, or future are not likely to result in any adverse impact on human health.
No Public Health Hazard This category is used for sites that, because of the absence of exposure, do NOT pose a public health hazard.	Sufficient evidence indicates that no human exposures to contaminant media have occurred, none are now occurring, and none are likely to occur in the future.	

*Such as environmental and demographic data; health outcome data; community health concerns information; toxicological, medical, and epidemiological data; monitoring and management plans

Appendix D

Explanation of Evaluation Process

Explanation of Evaluation Process

Screening Process

In evaluating available data, BCEH uses comparison values (CVs) to determine which chemicals to examine more closely. CVs are contaminant concentrations found in a specific media (air, soil, or water) and are used to select contaminants for further evaluation. Comparison values are designed to be conservative and non-site specific, and therefore protective for all probable exposures. Their intended use is only to screen out contaminants which do not need further evaluation. They are not intended to be used as clean-up levels or to be indicators of public health effects. They are derived from toxicological information and incorporate assumptions of daily exposure to the chemical and a standard amount of air, water, and soil that someone may inhale or ingest each day. Generally, the assumptions used are very conservative (i.e., worst case).

As health-based thresholds, CVs are set at a concentration below which no known or anticipated adverse human health effects are expected to occur. Different CVs are developed for cancer and non-cancer health effects. Non-cancer levels are based on valid toxicological studies for a chemical, with appropriate safety factors included, and the assumption that small children (22 pounds or less) and adults are exposed every day. Cancer levels are the media concentrations at which there could be a one in a million excess cancer risk for an adult eating contaminated soil or drinking contaminated water every day for 70 years. For chemicals which both cancer and non-cancer numbers exist, the lower level is used to be protective. Exceeding a CV does not mean that adverse health effects will occur, just that more evaluation is needed.

If a chemical contaminant is selected for further evaluation, the next step is to identify which chemicals and exposure situations could be a health hazard. Child and adult exposure doses are calculated for COCs in site media (e.g., soil, groundwater, surface water, sediment, and biota). Exposure doses are the estimated amounts of a contaminant that people come in contact with under specified exposure situations. These exposure doses are compared to appropriate health guidelines for that chemical. Health guideline values are considered safe doses; that is, health effects are unlikely below this level. If the exposure dose for a chemical is greater than the health guideline, then the exposure dose is compared to known health effect levels identified in ATSDR's toxicological profiles and other scientific references. If the chemical of concern is a carcinogen, the cancer risk is also estimated. These comparisons are the basis for stating whether the exposure is a health hazard.

CVs used in this document and previous health consultations are listed below:

Environmental Media Evaluation Guides (EMEGs) are estimated contaminant concentrations in a media where non-carcinogenic health effects are unlikely. The EMEG is derived from the Agency for Toxic Substances and Disease Registry's (ATSDR) minimal risk level.

Cancer Risk Evaluation Guides (CREGs) are estimated contaminant concentrations that would be expected to cause no more than one additional excess cancer in one million persons exposed

over a lifetime. CREGs are calculated from the Environmental Protection Agency's (EPA) cancer slope factors (CSFs).

Lifetime Health Advisories (LTHAs) are derived by EPA from a drinking water equivalent level below which no adverse noncancer health effects are expected to occur over a 70-year lifetime.

Lowest-Observed-Adverse-Effect-Level (LOAEL) is defined as the lowest dose of chemical in a study, or group of studies, that produces statistically or biologically significant increases in the frequency or severity of adverse effects between the exposed population and its appropriate control.

National Ambient Air Quality Standards (NAAQS) are developed by EPA to protect people and the environment from unhealthy and undesirable levels of air pollution. NAAQS have been developed specifically to protect the health and welfare of humans. To be conservative, these standards were designed to be protective of exposed persons, including the most "sensitive" populations (e.g., persons with asthma).

No-Observed-Adverse-Effect-Level (NOAEL) is defined as the lowest dose of chemical at which there were no statistically or biologically significant increases in the frequency or severity of adverse effects seen between the exposed population and its appropriate control. Effects may be produced at this dose, but they are not considered to be adverse.

Minimal Risk Levels (MRLs) are defined as an estimate of daily human exposure to a substance that is likely to be without an appreciable risk of adverse effects (non-carcinogenic) over a specified duration of exposure. MRLs are derived when reliable and sufficient data exist to identify the target organ(s) of effect or the most sensitive health effect(s) for a specified duration within a given route of exposure. MRLs are based only on noncancerous health effects, and do not considered carcinogenic effects. MRLs can be derived for acute, intermediate, and chronic durations of exposure.

Maximum Contaminant Levels (MCLs) are enforceable drinking water regulations established by EPA under the Safe Drinking Water Act that are protective of human health to the extent feasible both technologically and economically. The MCL assumes exposure over a 70-year lifetime and ingestion of 2 liters of water per day.

Risk-Based Concentrations (RBCs) are the estimated contaminant concentrations in which no chance exists for carcinogenic or noncarcinogenic health effects.

Secondary Maximum Contaminant Levels (SMCLs) are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. EPA recommends secondary standards to water systems but does not require systems to comply.

For radiological contaminants, BCEH uses information on radiation exposure and its effects related to environmental levels prepared by federal agencies, including EPA, DOE, and the Nuclear Regulatory Commission. BCEH and ATSDR also uses other publicly available data

sources and recommendations on radiation dose limits. The National Council on Radiation Protection and Measurements (NCRP), the International Commission on Radiological Protection (ICRP), and the United Nations Scientific Committee on the Effects of Atomic Radiation and others develop these sources.

Determination of Exposure Pathways

BCEH identifies human exposure pathways by examining environmental and human components that might lead to contact with contaminants of concern. A pathway analysis considers five principal elements: a source of contamination, transport through an environmental medium, a point of exposure, a route of human exposure, and an exposed population. Completed exposure pathways are those for which the five elements are evident, and indicate that exposure to a contaminant has occurred in the past, is currently occurring, or will occur in the future. Potential exposure pathways are those for which exposure seems possible, but one or more of the elements is not clearly defined. Potential pathways indicate that exposure to a contaminant could have occurred in the past, could be occurring now, or could occur in the future. It should be noted that the identification of an exposure pathway does not imply that health effects will occur. Exposures may, or may not be, substantive. Therefore, even if exposure has occurred, is occurring currently, or is likely to occur in the future, human health effects may not result.

BCEH reviews site history, information on site activities, and the available sampling data. Based on this review, BCEH identifies exposure pathways that warrant consideration. Additional information regarding the exposure pathways identified for the EMF site is provided in Appendix E of this public health assessment. If people are unlikely to be exposed to contaminants in a given pathway, then that pathway will not be evaluated further for human health risks.

Evaluation of Public Health Implications

The next step is to take those contaminants that are above the CVs and further identify which chemicals and exposure situations are likely to be a health hazard. Child and adult exposure doses are calculated for the site-specific exposure scenario, using our assumptions of who goes on the site and how often they contact the site contaminants. The exposure dose is the amount of a contaminant that gets into a person's body.

Appendix E

Exposure Pathways for Eastern Michaud Flats Contamination Site

Table E-1. Exposure Pathways for Eastern Michaud Flats Contamination Site

PATHWAY NAME	ENVIRONMENTAL MEDIA & TRANSPORT MECHANISMS	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSURE POPULATION	TIME	NOTES	STATUS
Soil	Spillage onto soil; erosion of waste to surface soils; deposition of fugitive dust	Site soil Off site soil	Incidental ingestion, inhalation, dermal exposure	Workers Nearby residents	Past, present, future	Population may include children.	Complete
Surface water	Surface water runoff over contaminated soil to river; dissolution of contaminants from sediment	Onsite Ponds Portneuf River	Incidental ingestion, inhalation, dermal exposure	Workers Nearby residents	Past, present, future	Population may include children.	Complete
Sediments	Spillage; deposition from surface water runoff into river	Onsite Ponds Portneuf River	Incidental ingestion, dermal exposure	Workers Nearby residents	Past, present, future	Population may include children.	Complete
Ground-water	Infiltration to groundwater	Groundwater wells supplying drinking water taps	Ingestion, inhalation, dermal exposure	Nearby residents	Past, present, future	Population may include young children.	Complete (past) Incomplete (present) Potential (future)
Air	Volatilization of contaminants; fugitive dust	On or near site soil	Inhalation, dermal exposure	Residents near the site	Past, present, future	Population may include young children	Complete
Slag	Radiation from the slag used in the community	In close proximity to slag	Radiation	Residents with slag in their homes and communities	Past, present, future	Population may include young children	Complete
Fish	Bioaccumulation of contaminants from surface water and sediments in fish	Meals prepared using fish from the Portneuf River	Ingestion	Sport fishers and their families	Past, present, and future	Population may include young children	Potential

Appendix F

Health Consultation: Surface Soil Contamination at the Eastern Michaud Flats Contamination Site

Appendix G

Health Consultation: Surface Water and Sediment Contamination at the Eastern Michaud Flats Contamination Site

Appendix H

Health Consultation: Groundwater Contamination at the Eastern Michaud Flats Contamination Site

Appendix I

Health Consultation:
Air Contamination at the Eastern Michaud Flats Contamination Site

Appendix J

Cancer Incidence Evaluation 1990-2001

Figure J-1 Eastern Michaud Flats Cancer Analysis Area

Table J-1. Comparison of cancer incidence rates between the Eastern Michaud Flats cancer analysis area and the remainder of the state of Idaho using all geocoded cases.

		Eastern Michaud Flats						Remainder of Idaho		
Cancer Site/Type	Sex	Observed Cases	Person Years	Crude Rate (1)	A.A.I. Rate (1,2)	Expected Cases (3)	P-Value (4)	Observed Cases	Person Years	Crude Rate (1)
All sites combined	Total	2,215	691,128	320.49	359.96	2,515.2	0.000 <<	54,935	13,440,017	408.74
All sites combined	Male	1,173	341,820	343.16	388.08	1,323.4	0.000 <<	29,421	6,719,684	437.83
All sites combined	Female	1,042	349,307	298.30	331.94	1,191.8	0.000 <<	25,514	6,720,333	379.65
Bladder	Total	121	691,128	17.51	20.08	116.1	0.674	2,590	13,440,017	19.27
Bladder	Male	88	341,820	25.74	29.42	90.7	0.831	2,037	6,719,684	30.31
Bladder	Female	33	349,307	9.45	10.69	25.4	0.168	553	6,720,333	8.23
Brain	Total	33	691,128	4.77	5.10	42.0	0.182	872	13,440,017	6.49
Brain	Male	23	341,820	6.73	7.16	24.5	0.871	512	6,719,684	7.62
Brain	Female	10	349,307	2.86	3.05	17.5	0.076	360	6,720,333	5.36
Breast	Total	323	691,128	46.74	51.65	379.0	0.004 <<	8,145	13,440,017	60.60
Breast	Male	3	341,820	0.88	0.99	2.5	0.921	56	6,719,684	0.83
Breast	Female	320	349,307	91.61	102.30	376.5	0.003 <<	8,089	6,720,333	120.37
Cervix	Female	18	349,307	5.15	5.46	24.5	0.221	499	6,720,333	7.43
Colon	Total	176	691,128	25.47	28.91	185.4	0.519	4,092	13,440,017	30.45
Colon	Male	80	341,820	23.40	26.69	89.3	0.351	2,003	6,719,684	29.81
Colon	Female	96	349,307	27.48	31.07	96.0	1.000	2,089	6,720,333	31.08
Endometrium	Female	56	349,307	16.03	18.05	69.6	0.108	1,508	6,720,333	22.44
Esophagus	Total	17	691,128	2.46	2.80	20.7	0.493	459	13,440,017	3.42
Esophagus	Male	13	341,820	3.80	4.31	15.8	0.584	352	6,719,684	5.24
Esophagus	Female	4	349,307	1.15	1.30	4.9	0.912	107	6,720,333	1.59
Hodgkin's Lymphoma	Total	11	691,128	1.59	1.60	19.2	0.062	376	13,440,017	2.80
Hodgkin's Lymphoma	Male	4	341,820	1.17	1.19	10.5	0.043 <<	209	6,719,684	3.11
Hodgkin's Lymphoma	Female	7	349,307	2.00	1.99	8.8	0.707	167	6,720,333	2.48
Kidney and Renal Pelvis	Total	45	691,128	6.51	7.33	58.7	0.076	1,285	13,440,017	9.56
Kidney and Renal Pelvis	Male	30	341,820	8.78	9.86	35.2	0.439	776	6,719,684	11.55
Kidney and Renal Pelvis	Female	15	349,307	4.29	4.82	23.6	0.082	509	6,720,333	7.57
Larynx	Total	14	691,128	2.03	2.31	20.2	0.195	448	13,440,017	3.33
Larynx	Male	11	341,820	3.22	3.65	16.3	0.224	364	6,719,684	5.42
Larynx	Female	3	349,307	0.86	0.97	3.9	0.912	84	6,720,333	1.25
Leukemia	Total	35	691,128	5.06	5.65	60.8	0.000 <<	1,320	13,440,017	9.82
Leukemia	Male	13	341,820	3.80	4.26	35.7	0.000 <<	787	6,719,684	11.71
Leukemia	Female	22	349,307	6.30	6.95	25.1	0.621	533	6,720,333	7.93
Liver	Total	13	691,128	1.88	2.12	14.9	0.745	327	13,440,017	2.43
Liver	Male	7	341,820	2.05	2.30	9.3	0.584	205	6,719,684	3.05
Liver	Female	6	349,307	1.72	1.94	5.6	0.984	122	6,720,333	1.82
Lung and Bronchus	Total	245	691,128	35.45	40.48	307.7	0.000 <<	6,832	13,440,017	50.83
Lung and Bronchus	Male	150	341,820	43.88	50.12	181.7	0.018 <<	4,079	6,719,684	60.70
Lung and Bronchus	Female	95	349,307	27.20	30.89	126.0	0.005 <<	2,753	6,720,333	40.97
Melanoma of the Skin	Total	69	691,128	9.98	10.87	100.1	0.001 <<	2,118	13,440,017	15.76
Melanoma of the Skin	Male	43	341,820	12.58	13.85	54.5	0.128	1,180	6,719,684	17.56
Melanoma of the Skin	Female	26	349,307	7.44	7.97	45.6	0.002 <<	938	6,720,333	13.96
Multiple Myeloma	Total	18	691,128	2.60	2.96	27.3	0.080	602	13,440,017	4.48
Multiple Myeloma	Male	11	341,820	3.22	3.66	15.0	0.366	336	6,719,684	5.00
Multiple Myeloma	Female	7	349,307	2.00	2.26	12.2	0.159	266	6,720,333	3.96
Non-Hodgkin's Lymphoma	Total	92	691,128	13.31	14.85	98.4	0.561	2,134	13,440,017	15.88
Non-Hodgkin's Lymphoma	Male	41	341,820	11.99	13.35	51.4	0.161	1,124	6,719,684	16.73
Non-Hodgkin's Lymphoma	Female	51	349,307	14.60	16.31	47.0	0.596	1,010	6,720,333	15.03
Oral Cavity and Pharynx	Total	54	691,128	7.81	8.82	64.7	0.198	1,421	13,440,017	10.57
Oral Cavity and Pharynx	Male	39	341,820	11.41	12.84	46.1	0.331	1,020	6,719,684	15.18
Oral Cavity and Pharynx	Female	15	349,307	4.29	4.80	18.6	0.477	401	6,720,333	5.97
Ovary	Female	59	349,307	16.89	18.59	50.1	0.241	1,062	6,720,333	15.80
Pancreas	Total	60	691,128	8.68	9.86	51.8	0.285	1,144	13,440,017	8.51
Pancreas	Male	25	341,820	7.31	8.33	26.2	0.913	587	6,719,684	8.74
Pancreas	Female	35	349,307	10.02	11.35	25.6	0.088	557	6,720,333	8.29
Prostate	Male	367	341,820	107.37	123.24	416.0	0.016 <<	9,387	6,719,684	139.69
Rectum & Rectosigmoid	Total	63	691,128	9.12	10.33	74.1	0.216	1,632	13,440,017	12.14
Rectum & Rectosigmoid	Male	40	341,820	11.70	13.32	42.1	0.818	943	6,719,684	14.03
Rectum & Rectosigmoid	Female	23	349,307	6.58	7.39	31.9	0.126	689	6,720,333	10.25
Stomach	Total	27	691,128	3.91	4.44	31.9	0.446	705	13,440,017	5.25
Stomach	Male	20	341,820	5.85	6.67	19.7	1.000	442	6,719,684	6.58
Stomach	Female	7	349,307	2.00	2.25	12.2	0.166	263	6,720,333	3.91
Testis	Male	29	341,820	8.48	8.38	19.8	0.061	384	6,719,684	5.71
Thyroid	Total	28	691,128	4.05	4.16	41.1	0.040 <<	821	13,440,017	6.11
Thyroid	Male	5	341,820	1.46	1.57	9.6	0.168	203	6,719,684	3.02
Thyroid	Female	23	349,307	6.58	6.71	31.5	0.143	618	6,720,333	9.20

Notes: 1. Rates are expressed as the number of cases per 100,000 persons per year (person-years).

2. Compare these age and sex-adjusted incidence (A.A.I.) rates to the crude rates for the remainder of the state of Idaho.

3. Expected cases are based upon age and sex-specific rates for the remainder of the state of Idaho (compare to observed).

4. P-values compare observed and expected cases, are two tailed, based upon the Poisson probability distribution.

"<<" denotes significantly fewer cases observed than expected, ">>" denotes significantly more cases observed than expected (p=.05).

Statistical Notes: Rates based upon 10 or fewer cases (numerator) should be interpreted with caution.

Rates shown for ZIP Code analyses are not comparable to those in state or county analyses due to population estimation procedures.

Table J-2. Comparison of cancer incidence rates between the Eastern Michaud Flats cancer analysis area and the remainder of the state of Idaho using cases geocoded to the Census Block Group quality or better.

		Eastern Michaud Flats						Remainder of Idaho		
Cancer Site/Type	Sex	Observed Cases	Person Years	Crude Rate (1)	A.A.I. Rate (1,2)	Expected Cases (3)	P-Value (4)	Observed Cases	Person Years	Crude Rate (1)
All sites combined	Total	2,204	691,128	318.90	357.99	2,110.9	0.045 >>	46,081	13,440,017	342.86
All sites combined	Male	1,163	341,820	340.24	384.66	1,097.0	0.050 >>	24,381	6,719,684	362.83
All sites combined	Female	1,041	349,307	298.02	331.53	1,013.9	0.403	21,700	6,720,333	322.90
Bladder	Total	121	691,128	17.51	20.09	97.8	0.026 >>	2,183	13,440,017	16.24
Bladder	Male	88	341,820	25.74	29.44	76.1	0.196	1,711	6,719,684	25.46
Bladder	Female	33	349,307	9.45	10.68	21.7	0.029 >>	472	6,720,333	7.02
Brain	Total	32	691,128	4.63	4.94	35.2	0.662	731	13,440,017	5.44
Brain	Male	22	341,820	6.44	6.84	20.3	0.761	424	6,719,684	6.31
Brain	Female	10	349,307	2.86	3.06	14.9	0.243	307	6,720,333	4.57
Breast	Total	322	691,128	46.59	51.48	327.6	0.785	7,039	13,440,017	52.37
Breast	Male	3	341,820	0.88	1.00	2.1	0.727	48	6,719,684	0.71
Breast	Female	319	349,307	91.32	101.97	325.4	0.748	6,991	6,720,333	104.03
Cervix	Female	18	349,307	5.15	5.48	19.9	0.780	407	6,720,333	6.06
Colon	Total	175	691,128	25.32	28.74	154.3	0.109	3,406	13,440,017	25.34
Colon	Male	79	341,820	23.11	26.36	73.5	0.549	1,647	6,719,684	24.51
Colon	Female	96	349,307	27.48	31.07	80.9	0.110	1,759	6,720,333	26.17
Endometrium	Female	56	349,307	16.03	18.03	59.6	0.701	1,290	6,720,333	19.20
Esophagus	Total	17	691,128	2.46	2.80	17.6	1.000	389	13,440,017	2.89
Esophagus	Male	13	341,820	3.80	4.31	13.4	1.000	298	6,719,684	4.43
Esophagus	Female	4	349,307	1.15	1.29	4.2	1.000	91	6,720,333	1.35
Hodgkin's Lymphoma	Total	11	691,128	1.59	1.59	16.9	0.176	329	13,440,017	2.45
Hodgkin's Lymphoma	Male	4	341,820	1.17	1.19	9.2	0.095	184	6,719,684	2.74
Hodgkin's Lymphoma	Female	7	349,307	2.00	1.97	7.7	0.999	145	6,720,333	2.16
Kidney and Renal Pelvis	Total	45	691,128	6.51	7.32	49.6	0.571	1,085	13,440,017	8.07
Kidney and Renal Pelvis	Male	30	341,820	8.78	9.86	28.8	0.879	637	6,719,684	9.48
Kidney and Renal Pelvis	Female	15	349,307	4.29	4.82	20.7	0.243	448	6,720,333	6.67
Larynx	Total	14	691,128	2.03	2.31	16.8	0.598	372	13,440,017	2.77
Larynx	Male	11	341,820	3.22	3.65	13.4	0.627	299	6,719,684	4.45
Larynx	Female	3	349,307	0.86	0.97	3.4	1.000	73	6,720,333	1.09
Leukemia	Total	35	691,128	5.06	5.66	51.0	0.023 <<	1,108	13,440,017	8.24
Leukemia	Male	13	341,820	3.80	4.26	29.4	0.001 <<	648	6,719,684	9.64
Leukemia	Female	22	349,307	6.30	6.98	21.6	0.986	460	6,720,333	6.84
Liver	Total	13	691,128	1.88	2.12	12.8	1.000	280	13,440,017	2.08
Liver	Male	7	341,820	2.05	2.30	8.0	0.903	177	6,719,684	2.63
Liver	Female	6	349,307	1.72	1.94	4.7	0.680	103	6,720,333	1.53
Lung and Bronchus	Total	245	691,128	35.45	40.48	256.6	0.493	5,697	13,440,017	42.39
Lung and Bronchus	Male	150	341,820	43.88	50.13	150.8	0.993	3,386	6,719,684	50.39
Lung and Bronchus	Female	95	349,307	27.20	30.88	105.8	0.317	2,311	6,720,333	34.39
Melanoma of the Skin	Total	68	691,128	9.84	10.70	83.2	0.100	1,760	13,440,017	13.10
Melanoma of the Skin	Male	42	341,820	12.29	13.52	45.8	0.642	990	6,719,684	14.73
Melanoma of the Skin	Female	26	349,307	7.44	7.96	37.4	0.063	770	6,720,333	11.46
Multiple Myeloma	Total	18	691,128	2.60	2.95	23.1	0.340	509	13,440,017	3.79
Multiple Myeloma	Male	11	341,820	3.22	3.66	12.5	0.804	280	6,719,684	4.17
Multiple Myeloma	Female	7	349,307	2.00	2.26	10.6	0.349	229	6,720,333	3.41
Non-Hodgkin's Lymphoma	Total	92	691,128	13.31	14.84	83.0	0.347	1,799	13,440,017	13.39
Non-Hodgkin's Lymphoma	Male	41	341,820	11.99	13.33	43.4	0.794	948	6,719,684	14.11
Non-Hodgkin's Lymphoma	Female	51	349,307	14.60	16.31	39.6	0.091	851	6,720,333	12.66
Oral Cavity and Pharynx	Total	54	691,128	7.81	8.82	53.3	0.962	1,170	13,440,017	8.71
Oral Cavity and Pharynx	Male	39	341,820	11.41	12.85	37.2	0.813	824	6,719,684	12.26
Oral Cavity and Pharynx	Female	15	349,307	4.29	4.80	16.1	0.914	346	6,720,333	5.15
Ovary	Female	59	349,307	16.89	18.56	42.8	0.021 >>	904	6,720,333	13.45
Pancreas	Total	60	691,128	8.68	9.85	44.1	0.026 >>	974	13,440,017	7.25
Pancreas	Male	25	341,820	7.31	8.32	22.0	0.572	491	6,719,684	7.31
Pancreas	Female	35	349,307	10.02	11.35	22.2	0.014 >>	483	6,720,333	7.19
Prostate	Male	363	341,820	106.20	121.85	345.6	0.362	7,795	6,719,684	116.00
Rectum & Rectosigmoid	Total	63	691,128	9.12	10.32	61.4	0.869	1,351	13,440,017	10.05
Rectum & Rectosigmoid	Male	40	341,820	11.70	13.29	34.7	0.414	776	6,719,684	11.55
Rectum & Rectosigmoid	Female	23	349,307	6.58	7.39	26.6	0.559	575	6,720,333	8.56
Stomach	Total	27	691,128	3.91	4.45	26.2	0.920	579	13,440,017	4.31
Stomach	Male	20	341,820	5.85	6.68	16.3	0.419	366	6,719,684	5.45
Stomach	Female	7	349,307	2.00	2.25	9.9	0.468	213	6,720,333	3.17
Testis	Male	29	341,820	8.48	8.35	16.8	0.008 >>	325	6,719,684	4.84
Thyroid	Total	28	691,128	4.05	4.16	36.1	0.197	721	13,440,017	5.36
Thyroid	Male	5	341,820	1.46	1.58	8.2	0.340	175	6,719,684	2.60
Thyroid	Female	23	349,307	6.58	6.70	27.9	0.410	546	6,720,333	8.12

Notes: 1. Rates are expressed as the number of cases per 100,000 persons per year (person-years).

2. Compare these age and sex-adjusted incidence (A.A.I.) rates to the crude rates for the remainder of the state of Idaho.

3. Expected cases are based upon age and sex-specific rates for the remainder of the state of Idaho (compare to observed).

4. P-values compare observed and expected cases, are two tailed, based upon the Poisson probability distribution.

"<<" denotes significantly fewer cases observed than expected, ">>" denotes significantly more cases observed than expected (p=.05).

Statistical Notes: Rates based upon 10 or fewer cases (numerator) should be interpreted with caution.

Rates shown for ZIP Code analyses are not comparable to those in state or county analyses due to population estimation procedures.

Table J-3 American Indian/Alaska Native Invasive Cancer Incidence Counts and Rates for Bannock, Bingham, and Power Counties, Idaho, 1990-2001.

	Three Counties Combined			Bannock			Bingham			Power		
Primary Site	Rate	Cases	Pop	Rate	Cases	Pop	Rate	Cases	Pop	Rate	Cases	Pop
All Sites	344.6	100	63,571	682.3	79	26,172	130.6	20	34,575	38.4	1	2,824
Bladder	5.3	2	63,571	13.8	2	26,172	0.0	0	34,575	0.0	0	2,824
Brain	5.4	3	63,571	2.9	1	26,172	4.9	1	34,575	38.4	1	2,824
Breast	31.5	8	63,571	60.1	6	26,172	11.9	2	34,575	0.0	0	2,824
Breast in situ	4.9	2	63,571	5.5	1	26,172	4.9	1	34,575	0.0	0	2,824
Cervix	6.2	2	63,571	16.5	2	26,172	0.0	0	34,575	0.0	0	2,824
Colorectal	41.5	10	63,571	81.4	8	26,172	15.4	2	34,575	0.0	0	2,824
Endometrium	27.1	7	63,571	54.0	6	26,172	10.0	1	34,575	0.0	0	2,824
Esophagus	0.0	0	63,571	0.0	0	26,172	0.0	0	34,575	0.0	0	2,824
Hodgkin Lymphoma	0.0	0	63,571	0.0	0	26,172	0.0	0	34,575	0.0	0	2,824
Kidney and Renal Pelvis	8.9	3	63,571	22.9	3	26,172	0.0	0	34,575	0.0	0	2,824
Larynx	3.5	1	63,571	9.5	1	26,172	0.0	0	34,575	0.0	0	2,824
Leukemia	7.7	5	63,571	19.7	5	26,172	0.0	0	34,575	0.0	0	2,824
Liver and Bile Duct	13.0	3	63,571	32.3	3	26,172	0.0	0	34,575	0.0	0	2,824
Lung and Bronchus	29.4	9	63,571	51.7	6	26,172	18.3	3	34,575	0.0	0	2,824
Melanoma of the Skin	17.6	5	63,571	36.7	4	26,172	5.4	1	34,575	0.0	0	2,824
Myeloma	7.1	2	63,571	19.0	2	26,172	0.0	0	34,575	0.0	0	2,824
Non-Hodgkin Lymphoma	11.0	3	63,571	28.4	3	26,172	0.0	0	34,575	0.0	0	2,824
Oral Cavity and Pharynx	10.3	3	63,571	18.8	2	26,172	5.4	1	34,575	0.0	0	2,824
Ovary	8.6	4	63,571	21.7	4	26,172	0.0	0	34,575	0.0	0	2,824
Pancreas	6.5	2	63,571	16.0	2	26,172	0.0	0	34,575	0.0	0	2,824
Prostate	47.3	12	63,571	91.3	9	26,172	18.9	3	34,575	0.0	0	2,824
Stomach	26.0	6	63,571	43.2	3	26,172	17.5	3	34,575	0.0	0	2,824
Testis	3.9	3	63,571	9.2	3	26,172	0.0	0	34,575	0.0	0	2,824
Thyroid	0.0	0	63,571	0.0	0	26,172	0.0	0	34,575	0.0	0	2,824
Pediatric Age 0 to 19	14.5	4	27,322	35.5	4	11,030	0.0	0	15,062	0.0	0	1,230

Rates are per 100,000 and age-adjusted to the 2000 U.S. (18 age groups) standard.

Appendix K

ATSDR Glossary of Terms

ATSDR Glossary of Terms

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency with headquarters in Atlanta, Georgia, and 10 regional offices in the United States. ATSDR's mission is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. ATSDR is not a regulatory agency, unlike the U.S. Environmental Protection Agency (EPA), which is the federal agency that develops and enforces environmental laws to protect the environment and human health. This glossary defines words used by ATSDR in communications with the public. It is not a complete dictionary of environmental health terms. If you have questions or comments, call ATSDR's toll-free telephone number, 1-888-42-ATSDR (1-888-422-8737).

General Terms

Absorption
The process of taking in. For a person or an animal, absorption is the process of a substance getting into the body through the eyes, skin, stomach, intestines, or lungs.

Acute
Occurring over a short time [compare with chronic].

Acute exposure
Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with intermediate duration exposure and chronic exposure].

Additive effect
A biologic response to exposure to multiple substances that equals the sum of responses of all the individual substances added together [compare with antagonistic effect and synergistic effect].

Adverse health effect
A change in body function or cell structure that might lead to disease or health problems

Aerobic
Requiring oxygen [compare with anaerobic].

Ambient
Surrounding (for example, ambient air).

Anaerobic
Requiring the absence of oxygen [compare with aerobic].

Analyte
A substance measured in the laboratory. A chemical for which a sample (such as water, air, or blood) is tested in a laboratory. For example, if the analyte is mercury, the laboratory test will determine the amount of mercury in the sample.

Analytic epidemiologic study
A study that evaluates the association between exposure to hazardous substances and disease by testing scientific hypotheses.

Antagonistic effect
A biologic response to exposure to multiple substances that is less than would be expected if the known effects of the individual substances were added together [compare with additive effect and synergistic effect].

Background level
An average or expected amount of a substance or radioactive material in a specific environment, or typical amounts of substances that occur naturally in an environment.

Biodegradation
Decomposition or breakdown of a substance through the action of microorganisms (such as bacteria or fungi) or other natural physical processes (such as sunlight).

Biologic indicators of exposure study
A study that uses (a) biomedical testing or (b) the measurement of a substance [an analyte], its metabolite, or another marker of exposure in human body fluids or tissues to confirm human exposure to a hazardous substance [also see exposure investigation].

Biologic monitoring
Measuring hazardous substances in biologic materials (such as blood, hair, urine, or breath) to determine whether exposure has occurred. A blood test for lead is an example of biologic monitoring.

Biologic uptake
The transfer of substances from the environment to plants, animals, and humans.

Biomedical testing
Testing of persons to find out whether a change in a body function might have occurred because of exposure to a hazardous substance.

Biota
Plants and animals in an environment. Some of these plants and animals might be sources of food, clothing, or medicines for people.

Body burden
The total amount of a substance in the body. Some substances build up in the body because they are stored in fat or bone or because they leave the body very slowly.

CAP [see Community Assistance Panel.]

Cancer
Any one of a group of diseases that occur when cells in the body become abnormal and grow or multiply out of control.

Cancer risk
A theoretical risk for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Carcinogen
A substance that causes cancer.

Case study
A medical or epidemiologic evaluation of one person or a small group of people to gather information about specific health conditions and past exposures.

Case-control study
A study that compares exposures of people who have a disease or condition (cases) with people who do not have the disease or condition (controls). Exposures that are more common among the cases may be considered as possible risk factors for the disease.

CAS registry number
A unique number assigned to a substance or mixture by the American Chemical Society Abstracts Service.

Central nervous system
The part of the nervous system that consists of the brain and the spinal cord.

CERCLA [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980]

Chronic
Occurring over a long time [compare with acute].

Chronic exposure
Contact with a substance that occurs over a long time (more than 1 year) [compare with acute exposure and intermediate duration exposure]

Cluster investigation
A review of an unusual number, real or perceived, of health events (for example, reports of cancer) grouped together in time and location. Cluster investigations are designed to confirm case reports; determine whether they represent an unusual disease occurrence; and, if possible, explore possible causes and contributing environmental factors.

Community Assistance Panel (CAP)
A group of people from a community and from health and environmental agencies who work with ATSDR to resolve issues and problems related to hazardous substances in the community. CAP members work with ATSDR to gather and review community health concerns, provide information on how people might have been or might now be exposed to hazardous substances, and inform ATSDR on ways to involve the community in its activities.

Comparison value (CV)
Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.

Completed exposure pathway [see exposure pathway].

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)
CERCLA, also known as Superfund, is the federal law that concerns the removal or cleanup of hazardous substances in the environment and at hazardous waste sites. ATSDR, which was created by CERCLA, is responsible for assessing health issues and supporting public health activities related to hazardous waste sites or other environmental releases of hazardous substances. This law was later amended by the Superfund Amendments and Reauthorization Act (SARA).

Concentration
The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Contaminant
A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Delayed health effect
A disease or an injury that happens as a result of exposures that might have occurred in the past.

Dermal
Referring to the skin. For example, dermal absorption means passing through the skin.

Dermal contact
Contact with (touching) the skin [see route of exposure].

Descriptive epidemiology
The study of the amount and distribution of a disease in a specified population by person, place, and time.

Detection limit
The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

Disease prevention
Measures used to prevent a disease or reduce its severity.

Disease registry
A system of ongoing registration of all cases of a particular disease or health condition in a defined population.

DOD
United States Department of Defense.

DOE
United States Department of Energy.

Dose (for chemicals that are not radioactive)
The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An "exposure dose" is how much of a substance is encountered in the environment. An "absorbed dose" is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

Dose (for radioactive chemicals)
The radiation dose is the amount of energy from radiation that is actually absorbed by the body. This is not the same as measurements of the amount of radiation in the environment.

Dose-response relationship
The relationship between the amount of exposure [dose] to a substance and the resulting changes in body function or health (response).

Environmental media
Soil, water, air, biota (plants and animals), or any other parts of the environment that can contain contaminants.

Environmental media and transport mechanism
Environmental media include water, air, soil, and biota (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can

occur. The environmental media and transport mechanism is the second part of an exposure pathway.

EPA
United States Environmental Protection Agency.

Epidemiologic surveillance [see Public health surveillance].

Epidemiology
The study of the distribution and determinants of disease or health status in a population; the study of the occurrence and causes of health effects in humans.

Exposure
Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [acute exposure], of intermediate duration, or long-term [chronic exposure].

Exposure assessment
The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

Exposure-dose reconstruction
A method of estimating the amount of people's past exposure to hazardous substances. Computer and approximation methods are used when past information is limited, not available, or missing.

Exposure investigation
The collection and analysis of site-specific information and biologic tests (when appropriate) to determine whether people have been exposed to hazardous substances.

Exposure pathway
The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a source of contamination (such as an abandoned business); an environmental media and transport mechanism (such as movement through groundwater); a point of exposure (such as a private well); a route of exposure (eating, drinking, breathing, or touching), and a receptor population (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a completed exposure pathway.

Exposure registry
A system of ongoing follow-up of people who have had documented environmental exposures.

Feasibility study
A study by EPA to determine the best way to clean up environmental contamination. A number of factors are considered, including health risk, costs, and what methods will work well.

Geographic information system (GIS)
A mapping system that uses computers to collect, store, manipulate, analyze, and display data. For example, GIS can show the concentration of a contaminant within a community in relation to points of reference such as streets and homes.

Grand rounds
Training sessions for physicians and other health care providers about health topics.

Groundwater
Water beneath the earth's surface in the spaces between soil particles and between rock surfaces [compare with surface water].

Half-life (t½)
The time it takes for half the original amount of a substance to disappear. In the environment, the half-life is the time it takes for half the original amount of a substance to disappear when it is changed to another chemical by bacteria, fungi, sunlight, or other chemical processes. In the human body, the half-life is the time it takes for half the original amount of the substance to disappear, either by being changed to another substance or by leaving the body. In the case of radioactive material, the half life is the amount of time necessary for one half the initial number of radioactive atoms to change or transform into another atom (that is normally not radioactive). After two half lives, 25% of the original number of radioactive atoms remain.

Hazard
A source of potential harm from past, current, or future exposures.

Hazardous Substance Release and Health Effects Database (HazDat)
The scientific and administrative database system developed by ATSDR to manage data collection, retrieval, and analysis of site-specific information on hazardous substances, community health concerns, and public health activities.

Hazardous waste
Potentially harmful substances that have been released or discarded into the environment.

Health consultation
A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical [compare with public health assessment].

Health education
Programs designed with a community to help it know about health risks and how to reduce these risks.

Health investigation
The collection and evaluation of information about the health of community residents. This information is used to describe or count the occurrence of a disease, symptom, or clinical measure and to evaluate the possible association between the occurrence and exposure to hazardous substances.

Health promotion
The process of enabling people to increase control over, and to improve, their health.

Health statistics review
The analysis of existing health information (i.e., from death certificates, birth defects registries, and cancer registries) to determine if there is excess disease in a specific population, geographic area, and time period. A health statistics review is a descriptive epidemiologic study.

Indeterminate public health hazard
The category used in ATSDR's public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

Incidence
The number of new cases of disease in a defined population over a specific time period [contrast with prevalence].

Ingestion
The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see route of exposure].

Inhalation
The act of breathing. A hazardous substance can enter the body this way [see route of exposure].

Intermediate duration exposure
Contact with a substance that occurs for more than 14 days and less than a year [compare with acute exposure and chronic exposure].

In vitro
In an artificial environment outside a living organism or body. For example, some toxicity testing is done on cell cultures or slices of tissue grown in the laboratory, rather than on a living animal [compare with in vivo].

In vivo
Within a living organism or body. For example, some toxicity testing is done on whole animals, such as rats or mice [compare with in vitro].

Lowest-observed-adverse-effect level (LOAEL)
The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

Medical monitoring
A set of medical tests and physical exams specifically designed to evaluate whether an individual's exposure could negatively affect that person's health.

Metabolism
The conversion or breakdown of a substance from one form to another by a living organism.

Metabolite
Any product of metabolism.

mg/kg
Milligram per kilogram.

mg/cm2
Milligram per square centimeter (of a surface).

mg/m3
Milligram per cubic meter; a measure of the concentration of a chemical in a known volume (a cubic meter) of air, soil, or water.

Migration
Moving from one location to another.

Minimal Risk Level (MRL)
An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), non-cancerous effects. MRLs are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects [see reference dose].

Morbidity
State of being ill or diseased. Morbidity is the occurrence of a disease or condition that alters health and quality of life.

Mortality
Death. Usually the cause (a specific disease, a condition, or an injury) is stated.

Mutagen
A substance that causes mutations (genetic damage).

Mutation
A change (damage) to the DNA, genes, or chromosomes of living organisms.

National Priorities List for Uncontrolled Hazardous Waste Sites (National Priorities List or NPL)
EPA's list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

National Toxicology Program (NTP)
Part of the Department of Health and Human Services. NTP develops and carries out tests to predict whether a chemical will cause harm to humans.

No apparent public health hazard
A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.

No-observed-adverse-effect level (NOAEL)
The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

No public health hazard
A category used in ATSDR's public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.

NPL [see National Priorities List for Uncontrolled Hazardous Waste Sites]

Physiologically based pharmacokinetic model (PBPK model)
A computer model that describes what happens to a chemical in the body. This model describes how the chemical gets into the body, where it goes in the body, how it is changed by the body, and how it leaves the body.

Pica
A tendency to eat nonfood items, such as dirt, paint chips, and clay. Some children exhibit pica-related behavior.

Plume
A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.

Point of exposure
The place where someone can come into contact with a substance present in the environment [see exposure pathway].

Population
A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

Potentially responsible party (PRP)
A company, government, or person legally responsible for cleaning up the pollution at a hazardous waste site under Superfund. There may be more than one PRP for a particular site.

ppb
Parts per billion.

ppm
Parts per million.

Prevalence
The number of existing disease cases in a defined population during a specific time period [contrast with incidence].

Prevalence survey
The measure of the current level of disease(s) or symptoms and exposures through a questionnaire that collects self-reported information from a defined population.

Prevention
Actions that reduce exposure or other risks, keep people from getting sick, or keep disease from getting worse.

Public availability session
An informal, drop-by meeting at which community members can meet one-on-one with ATSDR staff members to discuss health and site-related concerns.

Public comment period
An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

Public health action
A list of steps to protect public health.

Public health advisory
A statement made by ATSDR to EPA or a state regulatory agency that a release of hazardous substances poses an immediate threat to human health. The advisory includes recommended measures to reduce exposure and reduce the threat to human health.

Public health assessment (PHA)
An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health [compare with health consultation].

Public health hazard
A category used in ATSDR's public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances or radionuclides that could result in harmful health effects.

Public health hazard categories
Public health hazard categories are statements about whether people could be harmed by conditions present at the site in the past, present, or future. One or more hazard categories might be appropriate for each site. The five public health hazard categories are no public health hazard, no apparent public health hazard, indeterminate public health hazard, public health hazard, and urgent public health hazard.

Public health statement
The first chapter of an ATSDR toxicological profile. The public health statement is a summary written in words that are easy to understand. The public health statement explains how people might be exposed to a specific substance and describes the known health effects of that substance.

Public health surveillance
The ongoing, systematic collection, analysis, and interpretation of health data. This activity also involves timely dissemination of the data and use for public health programs.

Public meeting
A public forum with community members for communication about a site.

Radioisotope
An unstable or radioactive isotope (form) of an element that can change into another element by giving off radiation.

Radionuclide
Any radioactive isotope (form) of any element.

RCRA [see Resource Conservation and Recovery Act (1976, 1984)]

Receptor population
People who could come into contact with hazardous substances [see exposure pathway].

Reference dose (RfD)
An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

Registry
A systematic collection of information on persons exposed to a specific substance or having specific diseases [see exposure registry and disease registry].

Remedial investigation/Feasibility Study
The CERCLA process of determining the type and extent of hazardous material contamination at a site.

Resource Conservation and Recovery Act (1976, 1984) (RCRA)
This Act regulates management and disposal of hazardous wastes currently generated, treated, stored, disposed of, or distributed.

RFA
RCRA Facility Assessment. An assessment required by RCRA to identify potential and actual releases of hazardous chemicals.

RfD [see reference dose]

Risk
The probability that something will cause injury or harm.

Risk reduction
Actions that can decrease the likelihood that individuals, groups, or communities will experience disease or other health conditions.

Risk communication
The exchange of information to increase understanding of health risks.

Route of exposure
The way people come into contact with a hazardous substance. Three routes of exposure are breathing [inhalation], eating or drinking [ingestion], or contact with the skin [dermal contact].

Safety factor [see uncertainty factor]

SARA [see Superfund Amendments and Reauthorization Act]

Sample
A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see population]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

Sample size
The number of units chosen from a population or an environment.

Solvent
A liquid capable of dissolving or dispersing another substance (for example, acetone or mineral spirits).

Source of contamination
The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an exposure pathway.

Special populations
People who might be more sensitive or susceptible to exposure to hazardous substances because of factors such as age, occupation, sex, or behaviors (for example, cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Stakeholder
A person, group, or community who has an interest in activities at a hazardous waste site.

Statistics
A branch of mathematics that deals with collecting, reviewing, summarizing, and interpreting data or information. Statistics are used to determine whether differences between study groups are meaningful.

Substance
A chemical.

Substance-specific applied research
A program of research designed to fill important data needs for specific hazardous substances identified in ATSDR's toxicological profiles. Filling these data needs would allow more accurate assessment of human risks from specific substances contaminating the environment. This research might include human studies or laboratory experiments to determine health effects resulting from exposure to a given hazardous substance.

Superfund [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Superfund Amendments and Reauthorization Act (SARA)

Superfund Amendments and Reauthorization Act (SARA)
In 1986, SARA amended the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from substance exposures at hazardous waste sites and to perform activities including health education, health studies, surveillance, health consultations, and toxicological profiles.

Surface water
Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with groundwater].

Surveillance [see public health surveillance]

Survey
A systematic collection of information or data. A survey can be conducted to collect information from a group of people or from the environment. Surveys of a group of people can be conducted by telephone, by mail, or in person. Some surveys are done by interviewing a group of people [see prevalence survey].

Synergistic effect
A biologic response to multiple substances where one substance worsens the effect of another substance. The combined effect of the substances acting together is greater than the sum of the effects of the substances acting by themselves [see additive effect and antagonistic effect].

Teratogen
A substance that causes defects in development between conception and birth. A teratogen is a substance that causes a structural or functional birth defect.

Toxic agent
Chemical or physical (for example, radiation, heat, cold, microwaves) agents that, under certain circumstances of exposure, can cause harmful effects to living organisms.

Toxicological profile
An ATSDR document that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.

Toxicology
The study of the harmful effects of substances on humans or animals.

Tumor
An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

Uncertainty factor
Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-effect-level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people [also sometimes called a safety factor].

Urgent public health hazard
A category used in ATSDR's public health assessments for sites where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.

Volatile organic compounds (VOCs)
Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform.

Other glossaries and dictionaries:
Environmental Protection Agency (http://www.epa.gov/OCEPAterms/)

National Center for Environmental Health (CDC)
(http://www.cdc.gov/nceh/dls/report/glossary.htm)

National Library of Medicine (NIH)
(http://www.nlm.nih.gov/medlineplus/mplusdictionary.html)

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Appendix L

Eastern Michaud Flats Public Health Assessment Public Release Review Comments Addressed